High Seas Marine Protected Areas:
Concept and Discourse Analysis

by

Cheryle Fay Hislop

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Abstract

The notion of creating marine protected areas (MPAs) in the high seas has been hailed as "an idea whose time has come", and advocates are calling for them to be part of a global representative system to be established by 2012. This thesis argues that embedding the high seas MPA concept within the macro-goal of a global representative system by 2012, and the high seas epistemic community's persistence that this system be contained within an appropriate legal framework subsumes more pragmatic and politically acceptable "micro-actions". I suggest an alternative approach, namely a 'prototype' high seas MPA established by means of an informal agreement between a small number of countries that share both political will and technological capacity to make a difference. Prototypes enable policy diffusion: a successful programme draws attention and establishes de facto standards that can be diffused laterally and adapted to similar problems elsewhere. Counter-intuitively, if unsuccessful, the experience can be used to clarify what to do differently in the future.

The concept of a legally binding, globally representative system of high seas MPAs, and the fit this 'macro-concept' has within the vast and evolving global oceans governance 'seascape' is explored and critiqued against the backdrop of complex adaptive systems theory, components of international relations theory, and Rogers' diffusions of innovation. Complex adaptive systems theory provides a metaphorical framework for analysing and evaluating the arguments and motivation of the oceans conservation epistemic community in relation to the concept of high seas MPAs.

This thesis argues that development of politically contentious conservation arrangements such as high seas MPAs may have a better chance of success if they proceed by increments and are negotiated outside the limelight of a full-scale, temporally defined global programme. I argue that international acceptance of the high seas MPA concept stands to benefit from a more politically cautious 'micro-action' – a prototype – modelled on the 2004 agreement to protect *in situ* the wreck and remaining artefacts of the *Titanic* (the *Titanic* Accord). A high seas MPA prototype would allow Parties to develop a collaborative and cooperative rules-based regime to manage the actions of

their citizens involved in activities that may have a negative impact on a specific area of the marine environment.

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To believe something is to believe that it is true; therefore a reasonable person believes each of his beliefs to be true; yet experience has taught him to expect that some of his beliefs, he knows not which, will turn out to be false. A reasonable person believes, in short, that each of his beliefs is true and that some of them are false. I … expected better of reasonable persons.

W.V. Quine (1987, 21)

CHAPTER ONE

INTRODUCTION TO THESIS

Introduction

The oceans and seas of our planet are a vast and complex adaptive system harbouring diverse life forms, chemicals, processes, functions, goods and services, the quantities and qualities of which are, for the most part, incommensurable. This system of liquid, solids, gases, fauna, flora and geomorphic features covers approximately two thirds of the planet, yet astronauts walked on the moon (approximately 384,000 kilometres from Earth) nearly a decade before a group of geologists discovered a cluster of hydrothermal vents at a depth of 2500 metres on the Galapagos Rift[1] (Corliss et al 1979). The high seas component of the global oceans system – the water column, ocean floor and seabed located in areas beyond national jurisdiction - encompasses approximately half of the Earth's surface. Because ocean exploration and research requires enormous investments of money, expertise and time, our knowledge of open ocean environments and deep sea habitats remains inchoate and sparse.

Despite the prohibitive costs, deep ocean exploration has revealed, *inter alia*, oases of highly specialised chemosynthetic fauna at cold seeps and hydrothermal vent systems; seamounts rich with minerals, corals, and fish; cold, deep water coral communities and reefs as colourful and complex as those of the tropics; abyssal plains replete with Lilliputian fauna; deep sea trenches lined with thick bacterial mats; and vast metalliferous meadows of manganese nodules supporting epifaunal species (Baker et al 2001, 5-13; Butler et al 2001, 4-7; Thiel and Koslow 2001, 9). Although there are wide variations in estimates of the number of deep sea species[2], it is recognised that open ocean biological diversity is significantly high (Butler et al 2001, 4, 17-18). The global ocean system hosts 32 of the 34 phyla that have been discovered on Earth thus far, and it

[1] The Galapagos Rift is off the coast of Ecuador (Corliss et al 1979)
[2] Deep sea species are classified as those located beyond the edges of the continental shelf and in depths greater than 200 metres (Butler et al 2001, 4, 17-18).

is estimated that species per area unit is as high as 1000 species per square metre in the Indo-Pacific Ocean (Fenical et al 2002).

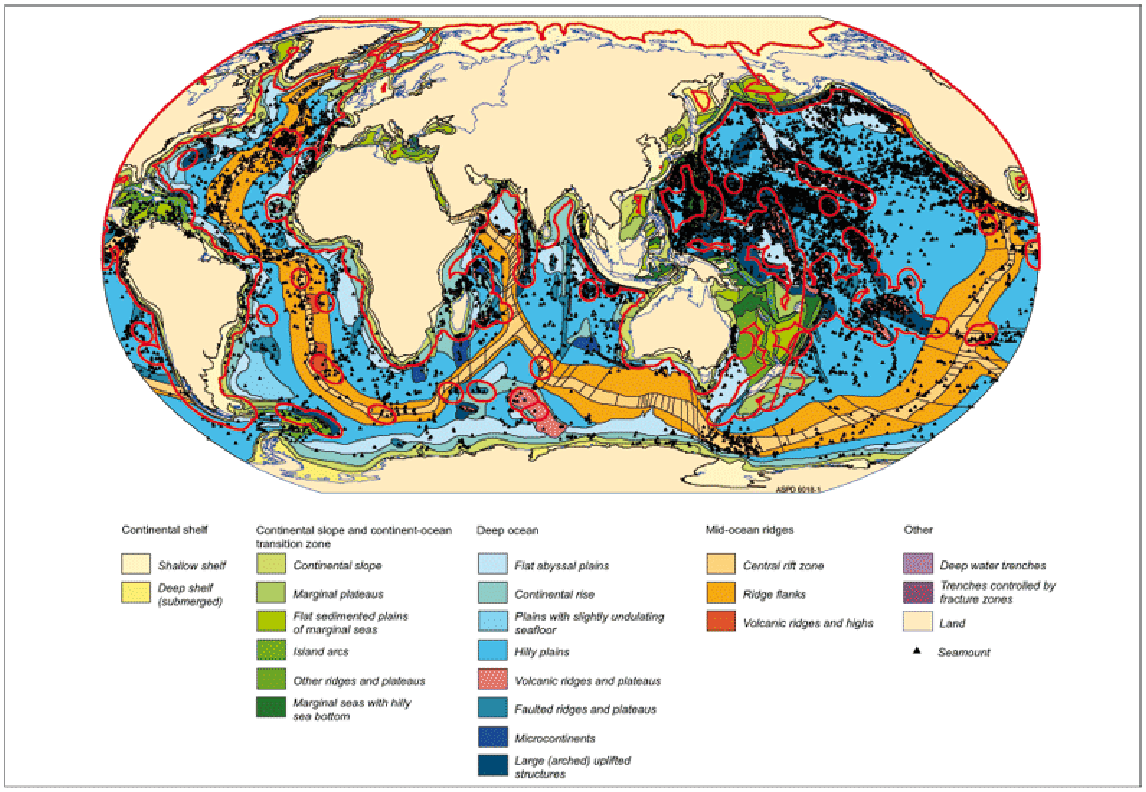
The deep ocean has been identified as one of the "last pristine habitats on Earth" (Butler et al 2001, 19). With the exception of seamounts, it is assumed that most deep sea biological communities have not been impacted significantly by human activities and as such they provide scientific researchers the opportunity to explore deep ocean "natural laboratories" where "the building blocks have not been tainted" (Butler et al 2001, 19). These natural laboratories also enable policy practitioners the opportunity to "test ideas on regulation of biodiversity" (Butler et al 2001, 19). Biological exploration at deep-sea hydrothermal vent sites has enabled scientists to construct simple models of life processes, and contemporary university text books in ecology and biology use examples from vent systems to demystify the processes of "symbiosis, detoxification, adaptation to extreme conditions and ecosystem function" (Butler et al 2001, 36; Juniper 2003, 3).

Figure 1 depicts the known locations of deep ocean geomorphic features. The largest deep-sea habitat is the abyssal sediment plain. This habitat type encompasses approximately 60 per cent of the ocean environment and there are few foreseeable threats to abyssal ecosystems apart from the potential impacts of polymetallic nodule mining (Johnston 2004, 4). Polymetallic nodules, first discovered during the *Challenger* expedition[3] of the late 19th century, cover vast areas of the ocean floor in depths of up to 6000 metres and are inhabited by a high diversity of epifauna. Estimates of the manganese, cobalt and nickel content of deep seabed nodule deposits far exceed existing terrestrial reserves, and it is believed that those with the greatest commercial value are located in the Indian and Pacific Oceans. It has been estimated that between five and ten billion tons of nodules of the immense 30 billion ton metalliferous meadow located along the Clarion-Clipperton Fracture Zone[4] are potentially exploitable (Baker et al 2001, 40-41). Nevertheless, deep seabed mining presents a considerable challenge, one

[3] The *Challenger* expedition (1872-76) was the world's first global oceans expedition during which a number of remarkable discoveries were made and a number of oceanographic and marine biology misperceptions and myths dispelled (Southampton Oceanography Centre online 2005).
[4] The Clarion-Clipperton Fracture Zone stretches from Hawaii to Mexico.

which has been compared to “standing atop a New York City skyscraper on a windy day, trying to suck up marbles off the street below with a vacuum cleaner attached to a long hose” (United Nations Division for Ocean Affairs and Law of the Sea 2002).

Figure 1: Map of seafloor geomorphic features (after Agapova et al 1979) with distribution of seamounts (after Kitchingham & Lai 2004) superimposed relative to the 200 mile EEZ (in Harris 2007)



Protecting Deep Oceans Biodiversity through a Global Representative System of Marine Protected Areas

In 1988, the World Conservation Union (IUCN) commenced a program to establish and promote a global representative system of marine protected areas (MPAs). This occurred six years after the Law of the Sea Convention (1982 LOSC[5]) was concluded and an ocean realm with geopolitical boundaries created. In the most simplistic sense, the marine environment now comprises two zones – those *within* national jurisdiction and

[5] I distinguish between the (1982) Law of the Sea Convention (LOSC) which is the formal agreement, and the Conventions (meetings) that were convened to negotiate the final instrument. In this thesis, the acronym for the latter is UNCLOS.

those *beyond*. The magical lines realised through the 1982 LOSC are, of course, more detailed than the two basic demarcations offered above, but in the context of high seas marine protected area discourse these are the two distinct areas of geopolitical difference. Although the 1982 LOSC clearly distinguishes between the water column (high seas) and the seabed (Area), for the sake of expediency, I use the term *high seas* throughout this thesis to refer to the water column *and* seabed, and will only make a distinction between the two where necessary.

The IUCN defines a marine protected area as: "Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment" (Kelleher 1999, xviii). Over several decades, the IUCN's promotion of the concept of a global representative system of marine protected areas has gathered force and other international environmental non-government organisations (NGOs) have joined to form a vanguard of MPA advocacy. Key figures from the Worldwide Fund for Nature (WWF), Greenpeace and the World Commission on Protected Areas (WCPA) have echoed the call in concert with marine researchers, coastal State government representatives, legal practitioners, academic institutions, and other international NGOs. A high seas epistemic community[6] has emerged through the decades of discussion and debate taking place in oceans governance fora and a network of communication built on shared eco-ethical principles and grand ambitions has been forged.

Although the initial focus of NGOs had been on the creation of MPAs within coastal state waters, technological advances in deep ocean research have enabled the discovery of magnificent features and creatures at incredible depths beyond areas of national jurisdiction. Attention was drawn toward protection of biodiversity in the deepest tracts of the ocean and concern was expressed that vulnerable high seas areas did not feature in a global representative protected areas system (IUCN 2003a).

[6] An *epistemic community* is defined as "a network of professionals with recognised expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain or issue area" (Haas 1989).

In 2001, the IUCN, WWF and WCPA commissioned a report on the status of natural resources on the high seas. The research mandate was to assess threats to high seas biodiversity and review the political and legal framework so that avenues for the creation of MPAs in areas beyond national jurisdiction could be identified. The high seas epistemic community met in Malaga, Spain in 2003 at a workshop convened by the IUCN, WWF and WCPA. The aim of the workshop was to develop an action plan to promote a system of high seas MPAs "to ensure long-term protection of ecosystem processes, biological diversity and productivity beyond national jurisdiction" (IUCN 2003a). Workshop participants agreed that high seas MPAs were 'an idea whose time had come' and that there appeared to be "clear recognition of the need for new tools to manage risks to biodiversity on the high seas" (IUCN 2003a).

The 2002 World Summit on Sustainable Development (WSSD) placed a temporal target of 2012 on the high seas epistemic community's primary tag and calls grew louder for high seas MPAs to be legitimised in a legally binding instrument. As such, post-2002 oceans governance fora have become constrained by the terms of reference within which the high seas MPA concept is framed and also by the magnitude of the task that has been set to achieve the 'macro-goal' of a global representative system. While some in the high seas epistemic community have proposed comparatively small scale steps toward designation, such as pilot high seas MPAs, this approach has become peripheralised in the grander scheme of things.

This thesis does not focus on high seas fishing practices even though this activity is the primary driver behind calls for the creation of high seas MPAs. Commercial fishing in and beyond coastal states' jurisdictions is a topic that has, and continues to be, extensively researched, examined and analysed and I shall leave it to others to continue this work. While the key concern of high seas MPA advocates is with the impacts of fishing, their focus is on habitat conservation and spatial management[7] as tools for

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[7] While some in the high seas epistemic community assert that the Pelagos Sanctuary for Marine Mammals (in force since 2001) represents the world's first high seas MPA, I do no agree with this view for two fundamental reasons: (i) the Pelagos Sanctuary spans the internal and territorial waters of France, Italy and the Principality of Monaco as well as international waters (Ardron 2007) and is, therefore, transboundary rather than a distinct high seas MPA; and (ii) the purpose of the Sanctuary is to protect

protecting valuable marine resources. It is the way in which they promote the concept of high seas spatial management – embedded in the tag of *a global representative system of MPAs by 2012* – that is the research motivation for this thesis.

Framework of Analysis and Thesis Structure

Chapter Overviews

Chapter One 'sets the scene' for analysis of high seas MPA discourse and the epistemic community determining the direction of this discourse. Figure 2 sets out the guiding framework showing the key research motivation, questions and corresponding chapters. At the heart of this thesis is the question of whether the current discourse around MPAs in areas beyond national jurisdiction represents an effective means of achieving them, if indeed high seas MPAs are 'an idea whose time has come'.

Chapter Two describes the discrete and distinctive geomorphic features of the high seas that have been identified as having scientific, social and/or commercial interest – seamounts, cold water corals, deep ocean sponge fields, deep sea trenches, polymetallic nodules, cold seeps and pockmarks, submarine canyons, and hydrothermal vents. Each section explores the geomorphology, geology, and fauna and flora of these features, and outlines current and potential threats.

The section on hydrothermal vents provides extensive detail and covers vent ecosystem functions[8] and services, scientific research being undertaken, the regulatory instruments

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cetaceans within a spatially demarcated area, thereby representing a species rather than biodiversity premised conservation measure.

[8] De Groot et al. (2002, 395-7) describe four primary categories of ecosystem functions:

1. Regulation functions: the capacity of natural and semi-natural ecosystems to regulate essential ecological processes and life-support systems through biogeochemical cycles and other biospheric processes. Resulting clean air, water and soil (among others) benefit humans.
2. Habitat functions: Natural ecosystems provide refuge and reproduction habitat to wild plants and animals, thereby contributing to the in situ conservation of biological diversity.
3. Production functions: Photosynthesis and nutrient uptake by plants makes carbo-hydrates available, directly or indirectly, for human consumption as food, raw materials, energy or genetic material.

relevant to activities occurring at various vent locations, and the extent of research into the potential commercial values of resources extracted or derived from vent systems. Chapter Two focuses on hydrothermal vent features because a vent site is identified as an ideal candidate for a prototype high seas MPA and this concept is explored in greater detail in Chapter Seven.

Chapter Three is a journey into the complex adaptive systems (*cas*) paradigm and its utility, especially in the metaphorical sense, for examining and analysing high seas MPA discourse, the high seas epistemic community, and the 'fit' of both discourse and community in the global oceans governance system. The global oceans governance system bears the four key characteristics that define a *cas* – adaptation, emergence, self-organisation and hierarchical organisation (Holland 1995) and evidence to support this will be reiterated throughout the thesis.

The value of metaphors as tools for analysis cannot be overstated. The seven 'basics' or organising principles of the *cas* paradigm (Holland 1995) provide the metaphors that are applied throughout this body of research. Classified as either properties or mechanisms, they enable us to treat *all* complex adaptive systems as families of related agents and to synthesise characteristics, principles and features into a simple model (Levin 1999, 13). These seven 'basics' – (i) aggregation; (ii) tags and tagging; (iii) non-linearity; (iv) flows; (v) diversity; (vi) internal models; and (vii) building blocks – will be used to drill more deeply into the high seas epistemic community and its MPA discourse.

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4. Information functions: Because most of human evolution took place within undomesticated habitats, natural ecosystems provide an essential "reference function" and contribute to human health by providing opportunities for reflection, spiritual enrichment etc.

The ecosystem function concept provides the empirical basis for classifying (potentially) useful aspects of ecosystems; observed ecosystem functions are reconceptualised as ecosystem services or goods once human values are implied. Inherently anthropocentric, "the human being as valuing agent" (p 395) enables the packaging of basic ecological functions into value laden entities. An example is that of the ecosystem function of supplying genetic resources: the ecosystem component is that of supplying genetic material and contributing to the evolutionary process in wild fauna and flora while the ecosystem service (and resulting goods) is that of supplying raw materials for drugs, pharmaceuticals, and test- and essay organisms (p396).

Figure 2: Guiding framework showing the key research motivation and questions and corresponding chapters.

Primary Research Question If high seas marine protected areas are indeed 'an idea whose time has come', what is the best means of achieving them?	**Chapter One** Introduction
Secondary Research Questions What is found in areas beyond national jurisdiction and why might some of these features require protection?	**Chapter Two** A Journey through Davey Jones' Locker
What theory helps explain the global oceans governance system, the high seas epistemic community and high seas MPA discourse?	**Chapter Three** High Seas Marine Protected Areas, the Global Oceans Governance System and the Complex Adaptive Systems Paradigm
Who is driving high seas MPA discourse and how is the concept being promoted?	**Chapter Four** Emergence of the Macro-Goal Era and the High Seas Epistemic Community 1972-2002
What has been the impact of high seas MPA discourse on the governance system in which it is played out?	**Chapter Five** The Influence of the High Seas Epistemic Community on High Seas Marine Protected Area Discourse 2002-2008
By drilling deeper into high seas MPA discourse, can alternative and more effective means of achieving their creation be identified?	**Chapter Six** High Seas Marine Protected Area Discourse Analysis
What *is* the most effective means?	**Chapter Seven** Innovation, Diffusion and Adaptation: A Prototype High Seas Marine Protected Area to Test the Concept **Chapter Eight** Summary and Conclusions

In a nutshell, the high seas epistemic community is an aggregate of non-diverse actors promoting the concept of high seas MPAs by embedding their development in the macro-goal – the community's primary tag – of *a global representative system of MPAs by 2012*. The actors within the community are bound by shared eco-ethical internal models and building blocks, and connected by flows of selective information within and beyond their network. They have emerged as leaders in high seas MPA discourse through repeated use of their primary tag and promoting their social priority goal of protecting biodiversity in *all* the world's oceans.

Chapter Four provides historical context (1972 – 2002) to, and evidence of the rise of macro-goals driven by eco-ethical ideologues in multilateral environmental policy development, the growing influence of international environmental NGOs in this arena, and the emergence of a high seas epistemic community and its primary tag of *a global representative system of MPAs*. It looks more closely at patterns of behaviour among participants at large scale environmental NGO gatherings and how repetitive language and terminology has evolved into a suite of building blocks for protection of oceans biodiversity in areas beyond national jurisdiction. Chapter Four closes with the 2002 World Summit on Sustainable Development (WSSD) and the high seas epistemic community's perception that its primary tag had finally been 'legitimised' through its expression in Section 32(c) of the Johannesburg Plan of Implementation.

Chapter Five looks at how the patterns of behaviour identified in Chapter Four have manifested in emergent phenomena at more 'formal' oceans governance gatherings convened under the authority of the United Nations from 2003 to 2008. The flurry of post WSSD NGO activities, interactions and relationships – action settings – is also captured. Clearly inspired by the legitimisation of its primary tag, the high seas epistemic community 'got down to business' devising strategies, plans of action and identifying governance instruments so that high seas MPAs discourse could move from rhetoric to action.

Chapter Six marks the introduction of some additional theoretical components to support analysis of high seas MPA discourse and the high seas epistemic community within the *cas* paradigmatic framework. As Ostrom (1990, 24) reminds us, "[t]he power of a theory is exactly proportional to the diversity of situations it can explain. All theories, however, have limits." While the *cas* paradigm taps a rich vein of analytical and metaphorical gold, the arguments tendered in Chapter Six are supported by the insights of Young (2004) and his examination of how the operation of environmental regimes and institutions influences the growth and dissemination of knowledge. It also goes some way toward explaining why and how the high seas epistemic community's primary tag of *a global representative system of MPAs* has endured in oceans governance discourse.

Chapter Six deconstructs the semantics of the primary tag, and analyses the 'fit' of the high seas epistemic community in the hierarchical organisation of the global oceans governance *cas* by examining the regularities and relationships between levels in the hierarchy. It also looks at the flows of information and knowledge within the high seas epistemic community and how these flows have led to a recycling of ideas and tags rather than enabling new agents and fresh ideas to feed into the network. The conclusion is that the high seas epistemic community would be better served by becoming more diverse in its membership and opening its feedback loops to new flows of information, ideas and opinions that challenge the current direction of oceans governance discourse.

The seven organising principles of the *cas* paradigm are applied to dissect and deconstruct the precepts and paradoxes of high seas MPA discourse, and a series of questions examines the value or otherwise of the high seas epistemic community's pursuit of, and persistence with legally binding options for developing and implementing MPAs in areas beyond national jurisdiction.

Chapter Seven explores the potential for a high seas MPA pilot site through the lens of Lasswell's 'prototyping' (1963) and Rogers' diffusion of innovations (1995) against the backdrop of the *cas* paradigm. To build a case for a more pragmatic and achievable process for creating high seas MPAs, the section on prototyping and diffusion of innovations is prefaced by a discussion of the managerial relevancy and natural appropriateness of small scale agreements within the frame of Jacobson and Brown Weiss' strategic design model for engaging countries in environmental accords (1998), and of course, the *cas* metaphors. I take my argument for a high seas MPA prototype a step further by suggesting it be realised through an informal accord between a few relevant parties ("mini-lateralism"[9]), rather than a multilateral global treaty, thereby reducing some margins for error because of the 'trialability' of the prototype, and the capacity to demonstrate its relative advantages or disadvantages on a significantly smaller geopolitical scale than that being proposed by the high seas epistemic community. A prototype high seas MPA, if successful, represents the ideal building block on which to base further development of marine protected areas beyond national jurisdiction.

The insight of Norton and Ulanowicz is referred to a number of times throughout this thesis in the context of establishing boundaries for systems analysis. They emphasise that selecting scales and determining boundaries in any complex adaptive system "...represents conceptualisations of the system that are *managerially relevant* and *naturally appropriate*" (Norton and Ulanowicz 1992, 247 original emphasis).

Chapter Eight synthesises the key points and conclusions from all preceding chapters to support the research motivation for this thesis, namely that if high seas MPAs are indeed 'an idea whose time has come', a prototype represents the most pragmatic and achievable first step for this concept, rather than embedding them in the priority social and macro-goal of *a global representative system of MPAs by 2012*. It also suggests a direction for further research and action informed by a recalibration of both the high seas MPA discourse and the priority social goals of the high seas epistemic community.

[9] The term 'mini-lateralism" was suggested by Matthew Sussex and employed by Kellow (2006, 302).

CHAPTER TWO

A JOURNEY THROUGH DAVEY JONES' LOCKER

Introduction

The scope of this thesis in terms of exploring the concept of marine protection in areas beyond national jurisdiction is limited to ocean floor geomorphic features rather than the water column or ocean surface areas, even though, as noted in Chapter One, the term "high seas" is used in a generic context throughout this thesis to denote ocean areas *and* seafloor beyond coastal states' jurisdictions. This does not mean that the latter are less worthy of protection – there are legitimate, sometimes compelling, reasons why particular ocean areas warrant marine protected area status, an example being that of the Sargasso Sea. Located off the southeast coast of the United States (US), the Sargasso Sea is a critical spawning ground for the European eel (*Anguilla anguilla*). In spectacular displays of mass migration, the eels travel from Europe, the Mediterranean, Japan and the US to mate, spawn and die (McCleave and Kleckner 1985, 316-337). The Sargasso Sea also harbours an abundance of microscopic biodiversity, with a cupful of Sargasso water sampled in 2003 containing at least 1,800 new microbial species bearing in excess of one million genes previously unknown to science (Nicholls 2004, 12). The value of pelagic marine reserves has also been researched, analysed and evaluated (see for example, Hooker and Gerber 2004, 27-39).

A number of discrete and distinctive deep ocean features have been identified as having scientific, social and/or commercial interest and which are, or may be, negatively impacted by human activities (Baker et al 2001, 3). The features which are examined in detail in this chapter are:

- Seamounts;
- Deep-sea coral communities;
- Deep sea sponge fields
- Deep-sea trenches;
- Polymetallic nodules
- Cold seeps and pockmarks;

- Submarine canyons; and
- Hydrothermal vents.

It is the potential phenomenon of ‘charismatic geomorphology’ that may hold the key to the success, or otherwise, of the world’s first prototype high seas marine protected area and as such, this chapter explores ocean floor geomorphic features. A large section of this chapter is devoted to detailing the features of hydrothermal vents because these underwater ‘volcanos’ seem ideal candidates for the world’s first prototype MPA in areas beyond national jurisdiction. The concept of prototyping, together with the virtues of diffusing innovation, is addressed in detail in Chapter Seven.

Charismatic geomorphology is an extension of the ‘charismatic megafauna’ campaign launched by the environmental movement in the latter half of the 20th century. To capture and direct public attention to ecological issues, non-government environmental organisations created the ‘charismatic megafauna’ approach. Whales, tigers, seals, elephants, dolphins and a litany of other large and impressive creatures were promoted to the status of iconic poster species to evoke concern about their welfare and also to train attention on the habitats in which they lived. The ongoing impact of the charismatic megafauna campaign is evident in the outpouring of public emotion around the world regarding the welfare of whales, particularly during the Japanese’ annual whale ‘research’ program in the Southern Ocean and the high media profile this activity commands. Intuitively, charismatic geomorphic features that are visually spectacular, ecologically intriguing, geologically fascinating and of critical value to the health of the world’s ocean systems, provide excellent candidates for high seas marine protected area prototypes. They can also evoke strong public interest in the status of the marine environment, the future of deep sea research and the impacts of commercial enterprise on deep ocean habitats.

Table 1: Scientific, societal and commercial interests and threats to deep-sea habitats (adapted from Baker et al 2001, 13 and updated)

Type	**Scientific Interest**	**Societal Interest**	**Commercial Interest**	**Current threats to habitat type**	**Potential threats to habitat type**
Hydrothermal vents	High for geology and biology; high endemism, low biodiversity, high abundance	High and increasing	High	Scientific research	Mineral extraction, energy source, biotechnology, biopharmaceutical
Seamounts	High for biology and geology; high endemism	Moderate-high and increasing	High	Fishing	Mineral extraction
Deep-sea trenches	Potentially high, but technologically challenging; unique hadal fauna; high endemism	Low	Low - moderate	None at moment but research may reveal pollution damage	Waste disposal
Deep-sea coral communities	High for geology and biology; high level of biodiversity	Moderate-high and increasing	High	Fishing	Biotechnology; biopharmaceutical; climate change
Manganese nodules	Moderate	Low	High	None, although mining trials underway	Mineral extraction
Cold seeps and pockmarks	High for geology and biology; high endemism	Low	High	None, limited oil and gas exploration	Mineral extraction
Submarine canyons	High for geology and biology; high biodiversity	Low	Medium – high	Fishing	Waste disposal
Deep sea sponge fields	High for biology; high biodiversity	Moderate	Low-medium	Fishing	Biotechnology

Table 2: Most developed human activities in the deep sea and seabed and impacts on habitats and ecosystems (adapted from United Nations Environmental Program 2007, 33).

Activity	Main impacts
Deep sea fishing	Continental shelves and slopes Seamounts Cold water corals Deep sea sponge fields
Hydrocarbon extraction	Seamounts Cold water corals Deep sea sponge fields
Deep sea mining	Continental shelves Abyssal plains Seamounts Cold water corals Deep sea sponge fields Hydrothermal vents
Waste disposal and pollution	All marine habitats
Cables	All marine habitats
Pipelines	All marine habitats, especially on continental shelves and slopes
Surveys/Marine scientific research	All marine habitats
Bioprospecting	Seamounts Continental shelves and abyssal plains Cold water corals Deep sea sponge fields Hydrothermal vents Cold seeps

The Geomorphic Features of Davey Jones' Locker

Table 1 lists the scientific, societal and commercial interests and current and potential threats to the deep ocean's geomorphic features. The following section provides an overview of these features, their geology, biology and current and potential anthropogenic impacts. While the impact on abyssal[10] and hadal[11] geomorphic features has so far been negligible, a number of real and potential threats have been identified

[10] The abyssal zone (between 4000 and 6000 metres) represents a significant portion of the oceans (Britannica Online Encyclopaedia 2010).

[11] The hadal zone, at depths of greater than 6000 metres, represents the deepest regions of the oceans (Britannica Online Encyclopaedia 2010).

and these are also addressed in some detail. Table 2 outlines the most developed human activities in the deep sea and the main habitats that are impacted.

Seamounts

Geomorphology and geology

Seamounts are steep, typically conical underwater mountains of volcanic or tectonic origin found beneath the surface of the sea. Looming up from the seabed, they are impressive geomorphic features that exceed heights of 1000 metres (features less than 1000 metres typically referred to as 'knolls' or 'hills'). 'Guyots' are flat topped seamounts, so formed because of wave action when originally above sea level (Baker et al 2001, 22).

Cobalt-rich crusts and polymetallic nodules are common at seamounts, particularly on those found in the Mediterranean and Pacific, thereby offering great potential for mining once the most cost effective and efficient extractive methods are developed (Baker et al 2001, 24).

Seamount life

Although first sampled by the *Challenger* expedition of 1872 – 76, biologists took little interest in seamount environments until the 1960s when significant fisheries increased their targets of orange roughy, pelagic armourhead and oreos, all species that aggregate around seamounts (Butler et al 2001, 24). Relatively recent studies of seamount biological diversity in the Tasman Sea indicate high levels of endemism. It is thought that distribution of seamount species and levels of endemicity are determined primarily by plate tectonic history and "the degree to which ridge systems and seamount chains provide 'stepping stones' between areas" (Butler et al 2001, 24). Seamount benthic fauna is dominated by suspension feeders such as corals with other conspicuous benthic fauna including sponges, hydroids[12], and ascidians (sea squirts). Approximately 600 invertebrate species have been documented at seamounts, however, as only five of the

[12] A coelenterate of an order which includes the hydras. Coelenterates are aquatic animals typically having a tube-or cup-shaped body with a single opening ringed with tentacles (Concise Oxford Dictionary Tenth Edition).

estimated 30,000 seamounts around the world accounted for 72 per cent of these recorded species, it is highly probable that many more species are yet to be discovered (Baker et al 2001, 23).

Studies to date indicate that fish biomass around seamounts is higher than in surrounding waters (Rogers 1994 in Baker et al 2001, 24). As areas of species aggregation, seamounts also attract high numbers of seabirds because of the abundance of pelagic organisms and reliability of food sources (Baker et al 2001, 24). Some seamounts also have associated hydrothermal venting, although biologically, seamount vents differ significantly from those located on mid-ocean ridges with very few ‘typical’ vent species detected (Rogers 1994 in Baker et al 2001, 24).

Current and potential threats

Overall, approximately 70 species of commercially valuable fish, shellfish and precious corals are found on or close to seamounts, rendering populations highly vulnerable to overfishing as a result of this aggregative effect (Baker et al 2001, 24). Compounding the problem of overfishing is the preferred method of capture for commercial fishstocks found around seamounts. Demersal trawling causes extensive physical damage to benthic fauna and flora, as well as impacting significantly on fish species that are long lived, slow to grow, have low fecundity, and which depend on healthy benthic flora and fauna for survival (Baker et al 2001, 25; Butler et al 2001, 25).

Precious corals found on seamounts have also been targeted for commercial harvesting, and although the cumulative ecological effect of this activity is not known, areas such as the Emperor-Hawaiian seamounts have been intensively harvested, with over 170,000 kilograms of red coral taken in 1983 alone (Baker et al 2001, 25).

Prospective miners are keen to find ways to exploit the oxidised deposits of cobalt-rich ferromanganese crusts found on the flanks and summits of seamounts, with the thickest crusts occurring on outer-rim terraces and on broad saddles on the summits of seamounts, at depths of 800 – 2,500 metres. Seamount crusts contain a much higher content of cobalt than that found in terrestrial deposits, and other valuable minerals such as titanium, cerium, nickel, and zirconium are also found in these oxidised deposits (International Seabed Authority 2005e). The marine mining industry is particularly interested in:

> ...large seamounts shallower than 1,000-1,500 metres, older than 20 million years and not capped by large atolls or reefs, located in areas of strong and persistent bottom currents, with a shallow and well-developed low-oxygen zone in the overlying water, and isolated from and abundant influx of river and wind-blown debris (International Seabed Authority 2005e).

Research and development of crust exploitation technology is in its infancy, primarily because cobalt crust mining is significantly more difficult than manganese nodule mining (International Seabed Authority 2005e). The International Seabed Authority (ISA), the regulatory body for mining in oceans beyond national jurisdiction[13], has called for more research into the nature of seamount biological communities "in order to develop a sound basis for recommendations on environmental impacts on crust exploration and mining" (International Seabed Authority 2005e). The ISA has also called for improved understanding of the ocean currents around seamounts so that "appropriate mining equipment and techniques can be developed, and dispersal routes of disturbed sediment particles and wastes can be determined" (International Seabed Authority 2005e).

Deep Sea Coral Communities

Reef life and morphology

Although relatively little is known or documented about deep sea corals, the knowledge base is growing because of advances in deep sea exploration technology and consequent academic and public interest in these cold water 'wonder worlds'. As such, concern about the conservation status is also increasing, primarily because evidence is mounting

[13] The International Seabed Authority (ISA) is an autonomous international organisation established under the aegis of the 1982 Law of the Sea Convention (LOSC), through which "States Parties shall organise and control activities in the Area in particular with a view to administering its resources of the Area", as articulated in Articles 156 (1) and 157 (1) of the Convention. Further, "[a]ll rights in the resources of the Area are vested in mankind (sic) as a whole, on whose behalf the Authority acts", as articulated in Article 137 (2) of the Convention. The Authority is also authorised to engage in seabed mining in its own right, through its commercial arm, the "Enterprise", as articulated in Article 170, Annex IV and the Agreement relating to Implementation of Part XI of the Convention (United Nations Division for Ocean Affairs and the Law of the Sea, and the International Seabed Authority 2004, 8).

that these ecosystems, some of which are being devastated by fishing practices, provide important, sometimes critical habitats for a variety of marine life including commercially valuable fishstocks (Etnoyer and Morgan 2003, 9).
Reef-building and habitat-forming cold water coral communities are derived from several systematic groups, with the most important of these being colonial stony corals (Scleratinia), true soft corals (Octocorallia), black corals (Antipatharia), and calcifying lace corals (Hydrozoa). Several species of these groups form reefs and three dimensional forest-like structures on the sea floor, rivalling their tropical cousins in both complexity and size (Freiwald et al 2004, 6). They are found in the cold, dark, nutrient-rich waters of fjords, around offshore submarine banks, on seamounts and along the fringes of continental shelves in almost all of the world's oceans and seas, with some species found in abyssal depths of almost 7000 metres (Freiwald et al 2004, 6, 12). Their slow growth rates are typical of cold, light-deprived environments (Freiwald et al 2004, 11), and cold water coral ecosystems function in a distinctively different way to shallow water coral systems. Because there is no light, they have no light-dependent symbiotic algae (marine plants) with which to flourish and rely instead on a supply of organic matter and zooplankton transported by currents for their sustenance (Freiwald et al 2004, 9). The most spectacular cold water coral communities are those made up of stony corals that vary from small scattered colonies no more than a few metres in diameter to vast reef complexes spanning several tens of kilometres (Freiwald et al 2004, 10).

Current and potential threats

The greatest damage inflicted on these communities is that of deep sea bottom trawling which reduces cold water corals to rubble, thereby obliterating areas vitally important as habitats, refugia, feeding grounds, and recruitment and nursery functions for a vast array of deepwater organisms (Freiwald et al 2004, 10-11). For example, trawl fishing for orange roughy and oreos caused significant destruction to the reef-building cold water coral, *Solenosmilia variabilis*, on the southern Tasmanian Seamounts. The most heavily fished seamount in the Tasmanian Seamount range was reduced to more than 90 per cent bare rock resulting in significant reduction of biomass and species richness (Baker et al 2001, 36).

Other current and potential threats to cold water corals include oil and gas exploration (where drill cuttings and mud dispersal may smother coral ecosystems), cable and pipeline placements, bioprospecting, carbon dioxide (CO^2) sequestration, pollution, waste dumping, and over-exploitation of commercially valuable corals (Baker et al 2001, 36; Freiwald 2004, 40-41).

Deep Sea Sponge Fields

Sponge Life and Locations

Approximately 5,000 species of sea sponges have been identified to date. Most live in the marine environment attached to firm substrate although some sponge species can survive on soft sediment courtesy of a root-like base. Sponges are primitive filter feeding animals with no internal organs, nervous system or muscles. As such, they prefer clear, nutrient-rich waters because continuous high sediment loads block their pores and decrease their capacity to feed and survive (United Nations Environmental Program 2007, 17).

Mass occurrences of large marine sponges (sponge fields) have been observed on continental shelves and slopes around, for example, the Faroe Islands, Iceland, East Greenland, off the coast of British Columbia, in the Skagerrak off Norway, in the Antarctic ocean, and the Barents Sea, with some originating more than 8,000 years ago. As is the case with most deep sea organisms, sponges are slow growing and long living, with some individuals reaching 80 kilograms in weight and living for more than a hundred years (United Nations Environmental Program 2007, 17).

Sponge fields provide a three dimensional structure to the seafloor, thereby enhancing habitat complexity and attracting invertebrate and fish populations around twice that of the surrounding soft substrates. For instance, sponge fields around the Faroe Islands are associated with approximately 250 species of invertebrates that inhabit the fields for shelter and nursery grounds (United Nations Environmental Program 2007, 17).

Current and potential threats

Sea sponges have weak cementation capacity which makes them highly vulnerable to the impacts of bottom trawling. This practice not only tears them from the substrate but also smothers them with the sediment blooms that the trawling gear creates. Sea sponges are also a significant source of substances with potential biotechnological and pharmaceutical purposes and values, with most of the 12,000 or so marine compounds isolated so far being obtained from sea sponges (United Nations Environmental Program 2007, 17).

Deep Sea Trenches

Geomorphology and geology

Found along island arcs and continental coastlines, the majority of deep sea trenches range in depths from 6,000 to 11,000 metres and comprise approximately one per cent of the total surface of the ocean floor. There are 37 deep sea trenches in the world's oceans, with 28 of these located in the Pacific Ocean, five in the Atlantic, and four in the Indian Ocean. The nine deepest are located in the Pacific Ocean in depths ranging from 9,000 to approximately 11,000 metres (Baker et al 2001, 28), with the deepest place in the ocean being the Challenger Deep (11,034 metres) in the Marianas Trench (United Nations Environmental Program 2006, 13).

Many deep sea trenches occur within coastal state's exclusive economic zones and most have features that are unique to that particular trench. Deep sea trenches are created during the subduction process – as the seafloor spreads, the oceanic crust buckles inwards and down to where two tectonic plates collide. The ocean crust is destroyed within the hot interior of the Earth, resulting in the formation of an elongated, narrow, and usually straight deep trench. It is also believed that because of high levels of local seismic activity, physically unstable conditions prevail at deep sea trenches (Baker et al 2001, 28).

Trench life

Prior to 1948 it was assumed that little if any life existed in the ocean in depths greater than 6,000 metres, however, this theory was overturned when scientific research expeditions undertaken by Russia (the *Vityaz* expedition of 1949 – 1962), and Denmark (the *Galathea* expedition of 1950 – 1952), provided evidence that life exists even at the high hydrostatic[14] pressures experienced in deep sea trenches (Baker et al 2001, 28).

Deep sea trenches support 'hadal fauna' that are largely unique because they have adapted to frequent physical disturbance, unusual trophic conditions and intense hydrostatic pressure. Trenches harbour numerous representatives of the majority of "free-living benthic taxonomic groups", and the diverse and abundant trench bacteria community plays a critical role in the diets of larger benthic fauna (Baker et al 2001, 29). Holothurians[15] dominate trenches in terms of biomass and density in the hadal zone, with bivalve molluscs and polychaetes[16] making up the bulk of the remainder of hadal fauna. The fine sediments that cover the bottom and lower slopes of deep sea trenches are ideal for holothurians which thrive on the detritus that settles on the trench floor (Baker et al 2001, 28-29). A high percentage of species are endemic to only one trench, primarily because of their high level of physical isolation. A colony of shellfish was recently discovered in a hadal depth of 7,326 metres in the Japan Trench. These shellfish appear to be sustained by chemosynthesis, suggesting that a range of chemosynthetic communities may exist in deep sea trenches (Fujikura et al 1999, 17-26).

Current and potential threats

While deep sea trenches have little commercial worth in terms of exploitation of minerals or fisheries, they are valuable in terms of scientific research as they provide unique laboratories for the study of ecological theories, including the study of faunal adaptability to extreme hydrostatic pressure (Baker et al 2001, 30).

[14] Relating to, or denoting the equilibrium of liquids and the pressure exerted by liquid at rest (Oxford Dictionary Tenth Edition).
[15] Sea cucumbers (Oxford Dictionary Tenth Edition).
[16] A class of marine annelid worms which comprises the bristle worms (Oxford Dictionary Tenth Edition).

Deep sea trenches have been identified as suitable for high level nuclear waste disposal, as well as disposal sites for mining tailings, decommissioned oil platforms, sewage sludges, dredge spoils and excess industrial CO^2. Because of tectonic activity and unstable physical conditions, the risks of using deep sea trenches as toxic waste disposal sites are not known. As biologically productive systems, contaminants may enter the marine (and ultimately the human) food chain, and because of tectonic activity, waters in deep sea trenches undergo rapid and thorough mixing above and below to the deepest reaches, thereby providing other means for marine contamination and toxic poisoning of trench fauna (Baker et al 2001, 31-32).

Polymetallic Nodules

Geomorphology and geology

Polymetallic nodules, also referred to as manganese nodules, were discovered at the end of the 19th century and are now known to occur in most oceans of the world. They are potato shaped rock concretions consisting of a core, such as a microfossil, shark tooth or fragment of another nodule, surrounded by concentric layers of iron and manganese hydroxide combined with varying amounts of other metals including nickel, copper, cobalt, and sometimes gold, silver, platinum, titanium, molybdenum, and/or zinc (International Seabed Authority 2005a; Baker et al 2001, 39). Over millions of years, the metal components precipitate from seawater onto sediments that cover the vast abyssal plains of the world's ocean (International Seabed Authority 2005f). They range in size from 1 centimetre to approximately 25 centimetres in diameter and lay half-buried in the seabed sediment with abundance varying according to location. The highest concentrations are usually found in depths of between 4,000 and 6,000 metres (International Seabed Authority 2005a).

Nodule life

While the surfaces of some forms of polymetallic nodules are inhabited by a diversity of epifauna composed of bacteria, protozoa[17], and metazoa[18], it is foraminifera[19] that are

[17] Protozoa: A phylum or group of phyla comprising the single-celled microscopic animals such as amoebas, flagellates, ciliates, and sporozoans (Concise Oxford Dictionary Tenth Edition).

the predominant taxonomic group associated with nodule environments (Mullineaux 1987 in Baker et al 2001, 40). It is believed that nodule size influences the type and number of sessile fauna occurring in a given area, with the lowest populations of megafauna noted in areas with a large volume of small, densely packed nodules, while regions with fewer but larger nodules provide ideal conditions for both mobile and sessile organisms (Foell et al 1989 in Baker et al 2001, 40).

The amount of nickel, cobalt and manganese in nodule deposits is thought to significantly exceed that available in known terrestrial reserves (Thiel et al 1993, 419). The polymetallic nodule aggregations with the highest commercial value are found in the Indian and Pacific Oceans (Baker et al 2001, 39). For example, in the Clarion-Clipperton Fracture Zone (CCFZ), an area of approximately five million square kilometres located between Hawaii and Mexico, it is estimated that between five and ten billion tons of nodules could be exploited from the approximately 30 billion tons that occur there. The CCFZ deposits are thought to have the highest known commercial value of any of the oceans' polymetallic 'meadows'. Nodules around the Cook Islands have also aroused the interest of the mining industry (Baker et al 2001, 41). System testing for polymetallic nodule mining at depths of 5,000 metres indicates that there will be no technical obstacles preventing these or similar deposits from being lifted off the seabed (International Seabed Authority 2005b).

Current and potential threats

While there is no current extractive activities in polymetallic nodule regions, deep sea mining is no longer a question of *if*, but *when*, as "it is likely that existing gaps in deep-seabed mining technology will be filled by advancing the technology of conventional systems", such as scraping, excavating, fluidizing, or tunnelling (International Seabed Authority 2005b). It has also been calculated that in order to achieve a reasonable return on investment, approximately one square kilometre of seafloor will need to be mined on

[18] Metazoa: A major division of the animal kingdom, comprising all animals other than protozoans and sponges (Concise Oxford Dictionary Tenth Edition).

[19] Foraminifera: A single-celled planktonic animal with a perforated chalky shell through which slender protrusions of protoplasm extend (Concise Oxford Dictionary Tenth Edition).

a daily basis, or around 6,000 square kilometres of seabed mined over the 20 year life of a mine site (Thiel, Foell and Schriever 1991 in Baker et al 2001, 41). Interestingly, most current claim applications for nodule mining exceed 100,000 square kilometres in area, representing a significant component of the Area that has been marked as exploitable (Thiel et al 1997 in Baker et al 2001, 41).

The greatest threat imposed by ocean mining is that of sediment plumes generated on the seabed, and via particle-laden water discharged from the mining platform. Sediment plumes may have impact extensively on the environment beyond the immediate vicinity of mining activity, including the possibility of smothering filter- and suspension-feeding nodule fauna (Baker et al 2001, 41). Baker et al (2001, 43) conclude that "commercial deep-sea mining for polymetallic nodules will have a significant impact on deep-sea benthic and pelagic communities", and that "the rate of recolonisation of disturbed areas will depend on the area swept for polymetallic nodules and on the timing and intensity of mining events". According to the ISA (2005b), engineers are now more inclined to take environmental consequences into account when designing deep-sea mining equipment. Further, to meet environmental standards being developed by the ISA, miners will have to:

> ...minimize the effect of the disturbance that their operations will inevitably cause as they crawl or dig over the seabed, raising clouds of sediment that will bury animals in their path and surroundings, and changing the chemical characteristics of ambient water. Thus efforts will be made to minimize the amount of sediment disturbed as nodules are gathered, not only for environmental reasons but also because the sediment is a waste material that dilutes the proportion of metals in the product to be processed. In addition, studies will be carried out to determine the best depth to discard the sediment that will inevitably be included as nodules are brought up, whether at the surface or some intermediate level where it might cause less harm to the surrounding life (International Seabed Authority 2005b).

The ISA has also drafted Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area. These were adopted in July 2000, and the Authority's Legal and Technical Commission has issued recommendations for the guidance of contractors on the assessment of the environmental impacts of exploration for polymetallic nodules (International Seabed Authority 2007g). When contractors apply for exploitation rights, the rules and regulations require that they propose areas to be set aside and used exclusively as "preservation reference zones" in which no mining can occur. This is to ensure that representative and stable biota of the seabed are not impacted by mining activities and any changes in the flora and fauna of the marine environment can be compared, analysed and assessed (Kimball 2005, 9-10).

Cold Seeps and Pockmarks

Geomorphology and geology

Seabed 'seepage' is a dynamic geological process that encompasses everything from energetic bubbling of gas from the seabed to microscopic bubbles emanating on a small scale or merely hydrocarbon compounds in solution. Seepage occurs in all the world's oceans and is associated with a variety of geological settings from the continental shelf, across the intervening slope, and into the deep oceans (Baker et al 2001, 45-46). Because so little of the deep ocean has been explored, the absolute number of seeps is unknown and difficult to assess (Baker et al 2001, 46). Seeps are related to a number of geological process and the origin of seep fluid may be hydrocarbon, hydrothermal, or volcanic, with seepage through some sediment types leading to the formation of 'pockmarks' (Baker et al 2001, 45). Pockmarks differ in size and form, both within and beyond areas, with circular and elliptical shapes the most common. They can measure up to several hundreds of metres in diameter, with depressions extending several tens of metres below seabed level (Baker et al 2001, 45).

Seep and pockmark life

The principal source of energy for seep and pockmark-associated biological communities is methane-rich fluid of either thermogenic[20] or biogenic[21] origin (Sibuet and Olu 1998, in Baker et al 2001, 45). Cold seeps have been explored at 24 sites ranging in depths from 400 to 6,000 metres in the Atlantic and Pacific Oceans and in the Mediterranean Sea, with research revealing an inventory of 211 chemosynthesis-based

[20] Thermogenic fluids are produced by high temperature and fast transformation of deeply buried organic matter (Sibuet and Olu 1998).

[21] Biogenic fluids are the product of microbial organic matter decomposition in anoxic sediment layers (Sibuet and Olu 1998).

species. Sixty four of these species host microbial symbionts (explained in more detail in the hydrothermal vent section below). Large bivalves (molluscs) from the families Vesicomydae and Mytilidae dominate seep communities (Baker et al 2001, 46).

Most seep fauna are endemic to single seep sites and to the cold-seep ecosystem, with only 13 of the 211 species inventoried thus far occurring at both seeps and hydrothermal vents (Sibuet and Olu 1998 in Baker et al 2001, 46). This may be because, unlike hydrothermal vents, the temperatures of seep flows differ only slightly from the surrounding water, and seep flow rates are significantly slower than those of vents (Butler et al 2001, 36). The majority of symbiont-containing species are also endemic to a single seep site, and seep communities have higher biodiversity than do hydrothermal vent sites. This may be explained by the duration of fluid flow, the sediment habitat and seep evolution (Sibuet and Olu 1998).

The value of seep communities to scientific research cannot be overstated and researchers have proposed a correlation between seepages and global biological productivity, estimating that the contribution made by chemosynthetic process from all submarine seepages (cold seeps, pockmarks and hydrothermal vents) is critical to the ecological health of the marine biomass (Hovland and Judd 1988).

Current and potential threats

The greatest potential threat to seep and pockmark habitats and associated fauna is from the oil and gas exploration industry and the physical disturbances caused by benthic trawling activities. To date, the impact of oil and gas exploration on seep ecosystems has not been well documented, but it is thought that exploratory drilling and the installation and operation of production platforms causes localised and wide spread disturbances, especially in the Gulf of Mexico where there are numerous seeps and a thriving offshore oil and gas industry (Butler et al 2001, 37). Future gas hydrate exploitation may also impact on seep ecosystems, as substantial reserves of methane ice have been found on the fringes of continental shelves where most cold seeps are believed to be located. Global estimates of gas hydrate reserves greatly exceed those of global fossil fuel reserves and although extraction technologies may be several decades away, exploitation could involve large scale disturbance of the seabed, thereby impacting significantly on cold seeps and other marine ecosystems (Butler et al 2001, 38). The biotechnology industry may also extend its exploration into seep bacteria with the same interest and enthusiasm it has demonstrated in hydrothermal vent organisms which are discussed in more detail below (Baker et al 2001, 47).

Submarine Canyons

Geomorphology and geology

Submarine canyons are v- or u-shaped features that typically cut across the continental slope, and less commonly the continental shelf, with some found on the slopes of oceanic islands such as the Hawaiian Islands. Each canyon is unique and characterised by shape, distance from shore, supply of sediment and organic matter, water flow, and sediment type. Most extend for less than 50 kilometres although there are canyons that exceed 320 kilometres. For instance, the Murray Canyon, located off the coast of South Australia and carving its way outward from the mouth of the Murray River, stretches for more than 150 kilometres with the main canyon plunging to a depth of 4,600 metres (Australian Marine Conservation Society 2007). The Murray Canyon system generates a rare upwelling of nutrient-rich waters at the southern edge of Australia's continental shelf. Turbid currents transport suspended material off the shelf and into the deep ocean and it is believed that this process is critical for the flow and descent of zooplankton and phytoplankton into the ocean depths (Australian Marine Conservation Society 2007).

Enormous fan-like sediments are found at the mouths of many submarine canyons leading researchers to the view that canyons are formed by abrasive ocean currents, turbidity currents, or are the result of seaward extensions of valleys that have been cut off from the continental shelf during periods when sea levels were lower. (Rowe 1971; Kenyon et al 1978; Australian Marine Conservation Society 2007).

Canyon life

Compared to their deep sea surrounds, canyons are recognised as areas of high microfaunal biomass, comparatively higher oxygen levels, and with quite different faunal composition from adjacent non-canyon depths (Australian Marine Conservation Society 2007; Vetter and Dayton 1998 in Baker et al 2001, 54). The physical characteristics of the canyon determine its fauna. As the largest canyons contain highly heterogenous habitat types, the result is that the epibenthic fauna of large canyon systems exhibit the highest diversity and greatest biomass (Baker et al 2001, 55). There is also a diversity of commercially valuable species such as lobsters, crabs, shrimp, flounder, hake, cusk and tilefish, primarily because of the wide variety of substrate types that provide refuge for adults and juveniles alike which makes canyons critical nursery grounds for fishstocks (Hecker 1989 in Baker et al 2001, 55).

Current and potential threats

Although many commercial fishstocks are found within submarine canyons, canyon geomorphology acts as a natural deterrent for fishing practices such as bottom trawling, fishers preferring long lines or traps for harvesting rather than have their trawl nets destroyed in the undulating habitat (Baker et al 2001, 56).

Activities associated with petroleum extraction pose potential challenges for canyon fauna through chemical contamination rather than sediment smothering – canyon fauna are insensitive to sediment deposition having adapted to survival in highly turbulent environments. Chemical contamination could lead to a reduction in recruitment as species in larval or early juvenile stages are more sensitive to toxicity than those in the later stages of development (Baker et al 2001, 56).

Example of a domestic management response

In response to anthropogenic threats to The Gully, the largest submarine canyon in Eastern North America, Canada declared the region a marine protected area in 2004. The Gully submarine canyon is located 200 kilometres off the coast of Nova Scotia and is 80 kilometres long with the canyon floor ranging from 200 metres to 2500 metres in depth. The Gully marine protected area comprises 2364 square kilometres in total and is regarded as an important and exceptional habitat harbouring a rich diversity of species (Fisheries and Oceans Canada 2008a). Rich in oil and natural gas fields and surrounded by exploration sites, the Canada Nova Scotia Offshore Petroleum Board adopted a "Gully Policy" which states that no new oil and gas activity will be permitted in the Gully Area because of the high levels of marine biodiversity. The Gully has the highest known diversity of coldwater corals in Atlantic Canada with 21 species identified to date. The Canadian Government has developed a comprehensive MPA Management Plan to ensure that all species and habitats in The Gully are conserved and protected (Fisheries and Oceans Canada 2008b).

Hydrothermal Vents

Geomorphology and geology

Since the discovery of the first hydrothermal vent system in 1977 on the Galapagos Rift, more than 100 hydrothermal vents[22] and approximately 500 new species of life along the 60,000 kilometre global mid-ocean ridge have been identified and documented (bearing in mind that only ten per cent of the global ridge system has been investigated thus far) (InterRidge Workshop 2000, 2; Baker et al 2001, 15; Juniper 2003, 3). Vents are also located along subduction zones, fracture zones, back-arc and fore-arc spreading centres and on seamounts. It is estimated that there may be approximately 500 vent systems distributed across the oceanic crust (Baker et al 2001, 15). Hydrothermal vents have also been discovered some distance from ocean ridges. Referred to as "off-axis" vent systems, they have much cooler emissions (40-75°C), and conditions significantly more alkaline than hydrothermal vents located on ocean ridge systems. Evidence is mounting that off-axis vents are more frequent than first thought, indicating that large sections of oceanic crust may be supporting hydrothermal activity and associated specialised life forms (Arico and Salpin 2005, 9-10). In 2003 an expedition located nine hydrothermal vents along a section of the Arctic's Gakkel Ridge (Marine Science Institute 2003), and

[22] The Hydrothermal Vent Database, published on the InterRidge website, counts 212 sites as of 1 December 2004, although this number includes "ascertained and suspected sites … where the presence of geological activity indicating vent formation was observed but no hydrothermal vent was located" (Arico and Salpin 2005, 13).   Fifty five of the 212 sites are located in waters beyond national jurisdiction (Arico and Salpin 2005, 14).

further exploration is scheduled for the Chile Rise, as well as areas of seabed around Antarctica, East Scotia Rise, and Bransfield Strait, (the stretch of water that constitutes the interface between the Pacific and Atlantic Oceans) (Shank 2004).

Hydrothermal vents are found in areas of tectonic plate activity and ridge formation that cause fissures on the seafloor through which seawater enters. The seawater is heated to extraordinary temperatures (typically in excess of 300 degrees Celsius) within shallow magmatic chambers and expelled back into the ocean environment at high velocity. Charged with dissolved metals and acids, the heated and enriched seawater resembles large plumes of smoke (known as white or black ‘smokers’) as it meets the cold deep-ocean waters. The cooling process causes the dissolved metals to precipitate and settle, forming vent ‘chimneys’ that can extend to over 20 metres in height (Baker et al 2001, 15; Marine Science Institute 2003; Census of Marine Life 2005). Black smoker vents contain zinc sulphide, iron sulphide, copper-iron sulphide (chalcopyrite), manganese oxide and iron oxide. White smoker vents appear white because the lower temperatures at these sites mean that sulphides precipitate amongst rocks, giving the plumes a pale cloudy appearance (Johnston 2004, 8). White smokers have significantly higher concentrations of zinc along with cadmium, silver and gold but less copper, iron, calcium and hydrogen sulphide than is found in black smokers (Tivey 1998, 2-3). Less common hydrothermal geomorphic structures include beehives, flanges (projecting rims or pieces) and complex sulphide deposits (Van Dover 2000, 49).

Vent Life - Natural Biological Laboratories

Hydrothermal vents and their biological communities are complex adaptive systems that represent “isolated ‘biological’ islands” (Baker et al 2001, 16). Ephemeral and intrinsically unstable, some vent systems appear and disappear in the space of a few decades as seafloor eruptions along the volatile mid-ocean ridge give rise to “rapid and significant changes in the location and style of venting” (Butler et al 2001, 31-32; see also Micheli et al 2002). Also described as “oceanic gardens of Eden” (Allen 2001), these energy-rich ecosystems found in depths greater than 400 metres support highly specialised biological communities that survive in extreme physical and chemical conditions not found beyond the hydrothermal environment (Baker et al 2001, 16,17; Butler et al 2001, 35). Known as *extremophiles*[23], these micro-organisms flourish in temperatures that fluctuate from near-freezing to more than 400 degrees centigrade, and in conditions that vary between oxygen rich bottom seawater with a pH of eight to anoxic, metal-dense fluids with a pH of two (Butterfield 2004, 4). The micro-organism's remarkable adaptive capacity means that the densest life concentrations are found in areas where hydrothermal vent fluids and seawater mix (Baker et al 2001, 16). These hydrothermal mixing zones are now recognised as hosting some of the highest biomass levels on Earth, with estimates of between 500 and 1000 times that of the biomass of surrounding, non-vent areas (Juniper 2003, 3). Quantitative abundance in hydrothermal vents does not, however, signify high levels of biodiversity; it is usually one or two species which account for between 70 and 90 per cent of vent biomass (Baker et al 2001, 18). Nonetheless, hydrothermal vents constitute a neatly definable, ecosystem-based natural laboratory. Table 3 lists the 'natural laboratory values' of hydrothermal vents.

Approximately 500 species have been identified at vent habitats thus far. Three phyla dominate these habitats - molluscs, anthropods[24], and annelids[25]. In addition to the three predominant phyla, 32 octopus and fish species have also been recorded as living on or around active deep-sea vent structures (Tunnicliffe, McArthur and McHugh 1998, 355, 364; Baker et al 2001, 16).

A key characteristic of vents is the high rates of endemicity found in individual hydrothermal biological communities. It is estimated that approximately 75 per cent of species are found at only one site (Baker et al 2001, 16). Hydrothermal species differ according to biogeographical location.[26] Vents located in the mid-Atlantic ridge support swarms of shrimp while those in the eastern Pacific are dominated by tubeworms. Both

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[23] An *extremophile* is an organism that thrives in conditions which are 'extreme' to humans. Two types of extremophile that are referred to frequently in the context of hydrothermal vent microbes are the *thermophile*, which thrives at temperatures 40°celsius or higher, and *hyperthermophile*, an organism with optimal growth at temperatures of 80°celsius or higher (Microbial Life Educational Resources 2005).
[24] Anthropods are crustaceans such as shrimp and crab.
[25] Annelids are segmented worms.
[26] Scientists have identified six major seafloor regions or biogeographical provinces, each with distinct assemblages of vent fauna. These are (i) the eastern Pacific; (ii) and (iii) two provinces in the north Atlantic; (iv) northeast Pacific; (v) western Pacific; and (vi) Central Indian ocean (Shank 2004).

areas support mussel populations but of different species, while vents in the western Pacific are populated by snails, mussels and barnacles not found in either the eastern Pacific or the Atlantic (Shank 2004). Depth also makes a difference: vents located in shallow waters (less than 300 metres depth) exhibit remarkably different rates of endemicity and biomass in contrast to those located at more extreme, light-deprived depths (InterRidge Workshop 2000, 2).

Table 3: Hydrothermal Vents - Natural Laboratory Values (adapted from Baker et al 2001; Juniper 2003)

- Pristine deep-sea habitats;
- Easily demarcated ecosystems;
- Isolated biological islands;
- High rates of species endemicity;
- High biomass/low biodiversity;
- Highly specialised fauna which have adapted to extreme physical and chemical conditions;
- Vent life fuelled by chemosynthetic rather than photosynthetic processes;
- Inspired new theories on origins of life on Earth and life on other planets;
- Unusual symbiotic relationships;
- 'Cospeciation' - evidence of symbiotic species which have evolved in synchrony;
- Biogeographically distinct populations;
- Critical role in chemical composition of oceans; and
- Host recently recognised third domain of life – *Archaea*.

Research into the life processes of vent communities has revealed that biological productivity is driven by chemosynthetic rather than photosynthetic processes. At the base of the vent trophic web are the *extremophiles*, micro-organisms which live at the vent-seawater mixing zone and which are fuelled primarily by the hydrogen sulphide emitted in hydrothermal plumes. With the aid of this fuel, vent micro-organisms produce organic matter from CO^2. Some chemosynthetic micro-organisms have formed symbiotic relationships with giant worms[27] and bivalves where the micro-organism's capacity to chemosynthesise nourishes both itself and its host. Others amass into free-growing biofilms and filamentous mats that cover mineral and animal surfaces and provide food sources for grazers and deposit feeders. Larger predators and scavengers complete the hydrothermal trophic web (Butler et al 2001, 30). Because hydrothermal vent fluids are formed by the reaction of hot rock and seawater, it stands to reason that "vent ecosystems are ultimately powered by heat from the earth's mantle" (Juniper 2001, 90).

While the light-deprived, deep-sea environment means that plant life cannot survive at such depths, the biological cycle of hydrothermal vents does not function independently of the photosynthetic process. All vent animals and many vent micro-organisms require dissolved oxygen for their metabolism, and dissolved oxygen in the ocean is a by-product of photosynthesis. As such there remains a critical bio-geochemical link between vent ecosystems and light-dependent upper water column and terrestrial ecosystems (Juniper 2001, 90).

Over the past decade there has been increasing scientific interest in species colonisation and re-colonisation of severely disturbed and newly formed vent sites. Biologists conjecture that species disperse between vents and that this phenomenon most probably occurs at the larval stage (Mullineaux and Manahan 1998, 6). Species' 'toughness' is probably due to their capacity to survive in, and adapt to, the dynamic and changing hydrothermal environment (Butler et al 2001, 32). Indeed, vent communities have demonstrated a remarkable capacity to recolonize following severe disturbances such as seafloor eruptions "as long as there are hydrothermal emissions to support microbial chemosynthesis" (Butler et al 2001, 35). High biomass and faunal species densities have been reached within a few years of severe disturbance at research sites, giving the impression that vent communities are highly resilient (Butler et al 2001, 35). Scientists

[27] These giant tubeworms (*Riftia pachyptila*) have the highest growth rate of any multicellular animal on Earth, growing at several tens of centimeters per annum (Lutz et al 1994 and Tunnicliffe et al 1997 in Butler et al 2001, 32).

have, however, expressed concern that the resilience argument may be used by those proposing deep-sea mining projects or wishing to harvest organisms for biotechnology and biopharmaceuticals (Butler et al 2001, 35). Evidence suggests that biomass and biodiversity are the highest at large, long-lived hydrothermal sites that probably host 'mother populations' critical to the continuation of vent species within a region. It is likely that because of the accumulation of large sulphide deposits at long-lived sites, these will be the most obvious targets for mining. The elimination of the mother population or severe alteration of vents following mining activities implies that it is highly unlikely that the site would or could be re-colonised (Butler et al 2001, 35). As vent sites have an extraordinarily high level of endemicity, there is the danger that some or even all species at the impacted site would be rendered extinct.

The biology of hydrothermal, chemosynthetic vent micro-organisms and the symbiotic relationships that have been forged with vent invertebrates has inspired new theories of the origin of life, and "prompted astrobiologists to seriously consider geothermal energy as a viable power source for biosynthesis and maintenance of carbon-based life forms on other worlds" (Juniper 2001, 89). Molecular biology techniques have provided evidence that chemosynthetic life at hydrothermal vents preceded photosynthetic life (Nisbett 2000, 625-626). Researchers have also been encouraged to examine biological phenomena at near-shore habitats following studies of chemosynthetic micro-organisms and the symbiotic relationships formed with vent invertebrates (Juniper 2001, 92). A recent study of vesicomyid clams at deep-sea hydrothermal vents has revealed a remarkable symbiotic relationship that has evolved into one of co-evolutionary synchrony. The vesicomyid clam hosts a bacterium in its tissues and the evolutionary patterns and timeframes of both species are mirrored in their genetic composition, indicating a newly-discovered phenomenon known as "cospeciation". Both species (clam and bacterium) have co-evolved in synchrony: rather than obtaining bacteria from the surrounding vent waters, the clams inherit bacterial starter cultures from their parent (Rosenthal 2003).

As well as contributing to research for the future, hydrothermal vents have also given scientists crucial new insights into the past. In 1982, scientists discovered a species of ancient life form known as *archaea* at a hydrothermal vent on the northern section of the East Pacific Rise. Until this discovery, scientists had recognised only two domains of life: (i) prokaryotes (cells without a nucleus, such as bacteria); and (ii) eukaryotes (cells with a nucleus, such as plants and animals). *Archaea* have no nucleus and between 50 and 75 per cent of their genes are not found in any other life form on Earth, therefore *archaea* are now recognised as the third domain of life (Duncan 2002).

Current and Potential Human Activities in Deep-sea Hydrothermal Vents

Marine researchers have been exploring hydrothermal vents for nearly three decades, and there is little doubt that the "discovery of chemosynthetic-based ecosystems at hydrothermal vents in the deep ocean [constitutes] one of the most important findings in biological science in the latter half of the 20th century" (InterRidge Workshop 2000, 2). Researchers were also surprised to find that the faunal diversity of abyssal plains, cold seeps and deep ocean trenches exceeds that of tropical rain forests, a remarkable achievement considering these are habitats located in an environment once believed to be the "marine equivalent of a desert" (Thiel and Koslow 2001, 9; Nichols 2004, 12). These discoveries have intensified the interest of biotechnology and biopharmaceutical companies in the deepest briny recesses of the planet. For example, the market potential for industrial uses of hyperthermophilic bacteria (just one of the many genetic resources discovered on the deep-sea bed) was estimated at approximately $3 billion per annum over a decade ago (Mann Borgese 1999).

In addition to the biotechnological prospects of vent and other deep-sea organisms, it is believed that the polymetallic massive sulphide deposits surrounding hydrothermal vent systems may be rich in valuable metals and precious stones and mining could become commercially viable within the next two decades (Glowka 1999). Vent systems are also viewed as potential sources of geothermal energy (InterRidge Workshop 2000, 8). Nonetheless, only a handful of countries possess the technology to conduct deep sea research at depths greater than 1000 metres. Japan, Russia, France, the US and the UK have deep sea research vehicles capable of descending to depths of 6000 metres (Arico and Salpin 2005, 24). It stands to reason that these countries will gain the most, both scientifically and commercially, from the genetic and marine resources at hydrothermal vent systems.

Ecosystem Functions[28] *and Services*

Hydrothermal vents play a critical role in the chemical composition of the oceans and therefore the geochemical balance of the Earth. All seawater circulates and re-circulates through vents and plumes, albeit over a very long period. The heat generated along volcanic mid-ocean ridges drives convection of seawater through the permeable ocean crust and the reactions that result from recirculation processes involve removal of some elements from seawater and the addition of others (InterRidge Workshop 2000, 5; Butler et al 2001, 29; Butterfield 2004). Regulation of ocean volume has also been linked to hydrothermal processes, and it is thought that weather patterns such as El Niño may also be controlled by hydrothermal activity (Baker et al 2001, 17). The ecosystem functions and services performed by hydrothermal vents and plumes contribute to ocean productivity and also affect localised circulation of seawater (Butler et al 2001, 29).

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[28] De Groot et al. (2002, 395-7) describe four primary categories of ecosystem functions:

5. Regulation functions: the capacity of natural and semi-natural ecosystems to regulate essential ecological processes and life-support systems through biogeochemical cycles and other biospheric processes. Resulting clean air, water and soil (among others) benefit humans.
6. Habitat functions: Natural ecosystems provide refuge and reproduction habitat to wild plants and animals, thereby contributing to the in situ conservation of biological diversity.
7. Production functions: Photosynthesis and nutrient uptake by plants makes carbo-hydrates available, directly or indirectly, for human consumption as food, raw materials, energy or genetic material.
8. Information functions: Because most of human evolution took place within undomesticated habitats, natural ecosystems provide an essential "reference function" and contribute to human health by providing opportunities for reflection, spiritual enrichment etc.

The ecosystem function concept provides the empirical basis for classifying (potentially) useful aspects of ecosystems; observed ecosystem functions are reconceptualised as ecosystem services or goods once human values are implied. Inherently anthropocentric, “the human being as valuing agent” (p 395) enables the packaging of basic ecological functions into value laden entities. An example is that of the ecosystem function of supplying genetic resources: the ecosystem component is that of supplying genetic material and contributing to the evolutionary process in wild fauna and flora while the ecosystem service (and resulting goods) is that of supplying raw materials for drugs, pharmaceuticals, and test- and essay organisms (p396).

Marine scientific research on hydrothermal vents

The most prevalent current anthropogenic impact on hydrothermal vent communities is that of marine scientific research (MSR). The deep-sea MSR community appears to have diverged over issues pertaining to the impact of research activities. Some vent researchers are campaigning for vents to be afforded the status of 'sanctuary' or 'reserve' (Mullineaux, Juniper and Desbruyères 1998, 15-16; Mullineaux et al 1998, 533,538; Johnson 2005, 105). Others take exception to the implication that vent scientific research is "uncoordinated and unregulated" and "one of the greatest threats to hydrothermal vent habitats" (Johnson 2005, 105; Tyler, German and Tunnicliffe 2005, 18).[29] Whatever position one assumes regarding the impact of marine scientific research on deep-sea habitats and fauna, there can be no dispute regarding the importance of MSR for improving our knowledge of the deep ocean and seabed. Marine scientific research also provides decision-makers with the most up-to-date data with which to inform management strategies and conservation decisions (Arico and Salpin 2005, 21-22).

Of the 100 documented hydrothermal vent sites along the global mid-ocean ridges, 12 are visited regularly by marine scientific researchers and several, including Endeavour (in Canadian waters) and Axial Volcano in the northeast Pacific; 9° North on the East Pacific Rise; Lucky Strike, Rainbow and possibly Menez Gwen on the Mid-Atlantic Ridge, are visited at least once per annum (Glowka 2003, 304). Some of these vent sites are located within coastal state waters and others are found in areas beyond national jurisdiction.

Over the past few years, the research focus has shifted to time series observations and long term studies which involve concentrated sampling and deployment of instruments at a small number of fixed hydrothermal vent 'observatories' (Butler et al 2001, 33). Changes in research focus at these vent sites have rendered the various research disciplines and methodologies incompatible and spawned "conflicts between biologists

[29] Tyler, German and Tunnicliffe's sentiments were expressed in a letter sent to *Nature* (2005) v434, 18, which they "signed on behalf of 18 international members of the ChEss [Biogeography of Chemosynthetic Ecosystems] programme steering group."

with different research approaches, and [between] biologists and geologists" (Mullineaux, Juniper and Desbruyères 1998, 15; Glowka 2003, 304). Mullineaux, Juniper and Desbruyères (1998, 15) identify three conflicting research types: (i) the "observers", who want undisturbed areas to be set aside for monitoring and measuring and who desire sanctuary status for the site under observation; (ii) the "experimentalists", who want access to vent systems which they can manipulate and then observe, and for these areas to be afforded 'restricted' status; and (iii) the "collectors" who want unfettered access to all sites to collect specimens irrespective of the wishes of the observers and experimentalists, and who have no desire to see any vent sites managed or regulated in any way.

Scientists have documented anthropogenically induced changes in the distribution and occurrence of vent fluid flows and vent communities along the east Pacific Rise, on the Juan de Fuca Ridge, and at the Trans-Atlantic Geotraverse (TAG) field on the Mid-Atlantic Ridge (Mullineaux, Juniper and Desbruyères 1998, 15). Marine scientific research activities have impacted directly on vent sites by contributing to habitat loss and species mortality. Documented activities and impacts include:

- Removal of chimneys and rocks for geological or chemical sampling;
- Environmental manipulation such as drilling which can alter fluid flow pathways or even shut off the supply of vent fluids to vent communities;
- Removal of fauna (sometimes complete removal) to aid research into re-colonisation, examine biodiversity, or study populations;
- Relocation of fauna to different sites;
- Placing instrument packages that may disturb fauna or alter fluid and seawater flows;
- Observation using incredibly bright lights on photosensitive organisms; and
- Damage caused by submersible thrust and lights[30].

(InterRidge Workshop 2000, 6; Glowka 2003, footnote 3 at 304).

[30] Marine scientific researchers have reported changes to the eyes of deep-sea hydrothermal vent shrimp as a result of "submersible illumination" (Herring et al 1999 in Johnson 2005, 105).

Documented second order biological effects of marine scientific research activities include decreases in population numbers, localised extinction of species; regional or global extinction of species; changes in vent geomorphology and biological community structure; and the introduction of exotic species via underwater vehicles and instruments (InterRidge Workshop 2000, 6; Glowka 2003, footnote 3 at 304).

Regulatory Instruments and Measures Relevant to Marine Scientific Research

As several vent sites have become the focus of intensive and long-term investigation some scientists advocate the introduction of "mitigative measures to avoid significant loss of habitat or oversampling of populations" (Butler et al 2001, 33). Members of InterRidge, an international multi-disciplinary research community exploring mid-ocean ridge vent systems, have developed the *InterRidge statement of commitment to responsible research practices at deep sea vents* which was signed by consensus on 17 February 2006. The Statement applies to InterRidge affiliated organisations and individuals conducting marine scientific research, and recommends that researchers subscribe to the following practices:

> 1) Avoid, in the conduct of scientific research, activities that will have deleterious impacts on the sustainability of populations of hydrothermal vent organisms.
>
> 2) Avoid, in the conduct of scientific research, activities that lead to long lasting and significant alteration and/or visual degradation of vent sites.
>
> 3) Avoid collections that are not essential to the conduct of scientific research.
>
> 4) Avoid, in the conduct of scientific research, transplanting biota or geological material between sites.
>
> 5) Familiarize yourself with the status of current and planned research in an area and avoid activities that will compromise experiments or observations of other researchers. Assure that your own research activities and plans are known to the rest of the international research community through InterRidge and other public domain data bases
>
> 6) Facilitate the fullest possible use of all biological, chemical and geological samples collected through collaborations and cooperation amongst the global

community of scientists (InterRidge 2006).

The signatories also reaffirmed their "commitment to open international sharing of data, ideas and samples in order to avoid unnecessary re-sampling and impact on hydrothermal vents, and to further our global understanding of these habitats for the good of all people on Earth." (InterRidge 2006).

Part XIII of the LOSC addresses issues pertaining to marine scientific research but does not define MSR itself (Arico and Salpin 2005, 15). According to the provisions of Part XIII, all States and competent international organisations have the right to undertake MSR in the world's oceans subject to the rights and duties of other states, although such research must be conducted for peaceful purposes, must not interfere with other legitimate uses of the seas, and must comply with all relevant regulations including those for the protection and preservation of the marine environment.[31] Nevertheless, marine scientific research, although subject to the aforementioned restrictions, is recognised as a high seas freedom.[32]

Part XIII distinguishes between MSR in the Area (Article 256) and that undertaken in the superjacent water column (Article 257). In relation to the latter, all States and competent international organizations have the right to conduct MSR in the water column seaward of the exclusive economic zone. While the same right applies to the Area, research must be conducted in conformity with the provisions of Part XI (Elferink 2007, 146-147).

The LOSC distinguishes between MSR undertaken to increase scientific knowledge for the benefit of all humankind (*pure* scientific research) and that which has "direct significance for the exploration and exploitation of natural resources" (*applied* scientific research).[33] This distinction does not, however, apply to MSR undertaken in oceans beyond national jurisdiction (Arico and Salpin 2005, 15). Prompted by the challenges of

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[31] Articles 238, 240, 256 and 257 of the Law of the Sea Convention.
[32] Article 87 of the Law of the Sea Convention.
[33] Article 246(5) of the Law of the Sea Convention.

distinguishing between pure (non-commercial) and applied (commercial) scientific research in practice, the Convention's drafters included a provision requesting that States "promote through competent international organisations the establishment of general criteria and guidelines to assist … in ascertaining the nature and implications of marine scientific research" (Article 251 of the LOSC cited in Arico and Salpin 2005, 16). These criteria and guidelines are still being developed.

It is highly likely that problems and conflicts about the nature of MSR will arise as bioprospecting becomes a viable commercial enterprise and the argument concerning the status of genetic resources and their status in the Convention becomes more urgent. The key issues underpinning debate concern the status of vent organisms, that is, whether they are living resources under Part VII or the common heritage of mankind under Part XI.

Deep-sea scientific researchers have the knowledge, technology, access and expertise to harvest primary and secondary organisms. If it is decided that genetic resources fall within the ambit of Part XI and are to be regulated, the nature and purpose of deep-sea research expeditions will then have to be clarified with the ISA and will be subject to its rules and regulations. Deep-sea research is an expensive and high-risk activity and while researchers are usually affiliated with universities or research institutions, they may also be contracted to, or funded by, a biotechnology or biopharmaceutical company willing to pay for samples collected from vents once the 'pure' scientific research is completed (Korn, Friedrich and Feit 2003, 52). Needless to say, such activity raises questions regarding the purpose and nature of marine scientific research, the primary challenge being whether it constitutes prospecting for resources under Part XI or whether it can it be construed as exploration and/or exploitation of living resources (Korn, Friedrich and Feit 2003, 52). While analysis of the legal status of deep sea organisms in the context of the legality of their appropriation is not within the scope of this thesis, the convoluted and difficult negotiations that led to the 1982 LOSC reflects the rocky terrain of international negotiation and law making and the legal minefield awaiting those attempting to resolve the issue of access and rights to genetic resources.

Determining the status and management authority for biotechnological activity in the high seas and Area is bound to reinvigorate the decades-old ‘wicked problems’ that beset those involved in the original LOSC negotiations. As is argued later in this thesis, those ‘wicked problems’ will also arise should the high seas epistemic community pursue an implementing agreement to the LOSC to create high seas MPAs.

Hydrothermal Vent Tourism

To fund marine scientific research at vent sites, Russian scientists collaborated with commercial tourist operators to take wealthy ‘eco-tourists’ to the Rainbow hydrothermal vents in Mir submersibles during 1999. As the Rainbow site is in international waters, the tour operators did not need to seek approval for the venture, nor were they required to submit any environmental impact assessments of their activities to any international or regional governing body, organisation or institution (Butler et al 2001, 33). Although vent tourism is at present relatively minor- scale, there is potential for an increase in this activity. There is also the possibility that deep-sea eco-tourists may demand souvenirs or samples as mementos of their expensive journey to the international ocean floor, resulting in altered or damaged vent structures. As such, some form of management or control of hydrothermal vent tourism may be required in the future.

Potential Impacts on Hydrothermal Vents

<u>Bioprospecting</u>*:* Hydrothermal vents are colonised by bacteria and archaea that can survive in extreme conditions such as high temperatures (in excess of 80°Celsius), extreme toxicity, intense pressure, and widely variable pH values (Arico and Salpin 2005, 10; Butler et al 2001, 34). These highly adaptive and physiologically peculiar vent micro-organisms have become sirens of the deep to biotechnology and biopharmaceutical companies. Enzymes extracted from vent extremophiles have a wide range of applications and it is anticipated that the market for these enzymes will expand at approximately 15 to 20 per cent per annum although this figure is contingent on development of economically viable extraction technologies (New England Biolabs Inc. in Baker et al 2001, endnote 20). Nevertheless, at least seven biotechnology companies are actively involved in research and development of commodities derived from

hydrothermal vent extremophiles, with three of the seven already marketing vent-derived products (Leary 2004, 143).

Most research and development of hydrothermal vent-derived extremophiles has focused on the utility of enzymes for a range of industrial and manufacturing processes including detergents, food production, waste water treatments, paper bleaching, and pulp and paper processing and recycling (Leary 2004, 142). More recent research has focused on potential pharmaceutical and therapeutic applications derived from a wide range of vent species including development of antifungal compounds (Phoebe and Combie 2001, 56) and production of artificial blood derived from haemoglobin found in the blood of tubeworms (Juniper 2004). A European company, Sederma, has isolated enzymes from extremophile bacteria found at deep-sea hydrothermal vents and developed commercial skin protection products which provide high-level ultra-violet (UV) resistance at high temperatures. A California-based skin care company is also developing and commercialising outdoor skin care products using the same enzymes (Arico and Salpin 2005, 20).

There is little data available on the potential biological impacts of extraction of micro-organisms. One possible impact, however, is that of secondary metabolite production where bioprospectors may require large amounts of a particular host organism in order to obtain the required genetic material from the micro-organism. This process may lead to over-harvesting, thereby threatening both host and micro-organism and possibly even the ecosystem from which they are harvested (Glowka 1999). Previous instances of the volume of specimens required for secondary metabolite extraction include the collection of 92.5 kilograms of a marine acorn worm by a United States bioprospecting group in order to isolate one milligram of an anticancer compound, and the harvesting of 174.6 kilograms of moray eel liver in order to isolate 0.35 milligrams of ciguatoxin[34] for research purposes[35] (Sochaczewski and Hyvarinen 1996, 15).

[34] Poison derived from toxic dinoflagellate carried by some marine species (Concise Oxford Dictionary Tenth Edition)
[35] The number of eels appropriated in order to obtain 174.6 kilograms of liver was not specified.

Regulatory Instruments and Measures Relevant to Bioprospecting***:*** There is currently no specific international regime addressing bioprospecting in the international seabed area or water column, although concerns about uncontrolled collection and exploitation of genetic resources in the high seas and Area have been raised in a number of prominent global fora (Arico and Salpin 2005, 8). For instance, during 2004, the United Nations General Assembly established an Ad Hoc Open-ended Informal Working Group to examine issues relating to conservation of marine biological diversity in areas beyond national jurisdiction, partly in response to concerns about the impacts of bioprospecting. Parties to the Convention on Biological Diversity also agreed in 2004 to gather information pertaining to the status of, and threats to, genetic resources in international waters and seabed, and examine issues relating to trends in bioprospecting as well as identifying activities that may have adverse impacts on deep seabed ecosystems (Arico and Salpin 2005, 8).

The existing legal framework for living and non-living resources located at hydrothermal vents in the Area consists of the following legal authorities and soft law instruments:

- The United Nations Convention on the Law of the Sea;
- The Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea;
- The International Seabed Authority;
- The Rio Declaration of Principles;
- Agenda 21;
- The Convention on Biological Diversity; and
- Customary Law.

(Korn, Friedrich and Freit 2003, 27)

While it is beyond the scope of this thesis to explore and analyse the application and effectiveness of the authorities and instruments relating to bioprospecting activities in hydrothermal vents located beyond national jurisdictions, the issue of bioprospecting in the context of the LOSC merits closer attention. Widely considered the “Constitution for the Oceans" (Koh 1982), the LOSC guides decisions relating to the world's oceans, seafloor, and seabed beneath. All decisions relating to the regulation and management of bioprospecting activities are, or will be, underpinned by the principles articulated in the LOSC.

The term 'genetic resource' is not found in the LOSC as it was drafted before such language was in use. Discussion and questions relating to genetic resources located in international waters have to date focused on questions of legal status (Arico and Salpin 2005, 30):

- Are they the common heritage of mankind and therefore fall within the ambit of Part XI?; or
- Are they analogous to the living resource/open access provisions of Part VII which addresses issues pertaining to the high seas?

If it is decided that they fall into the category of living marine resources then under the living resource provisions of Part VII, genetic species located at hydrothermal vents can be appropriated at will as both fishing and marine scientific research are high seas freedoms[36] that are subject to measures addressing conservation of living marine resources, protection of the marine environment, and the interests of other states (Arico and Salpin 2005, 30-31; Korn, Friedrich and Feit 2003, 40). Activities undertaken on the high seas are subject to flag State jurisdiction and many States are also parties to regional and international agreements that address anthropogenic activities and environmental impacts in waters beyond coastal state jurisdiction and which are intended to complement the Law of the Sea Convention. Given the restrictions and obligations imposed on most activities on the high seas and Area in the contemporary setting, the freedoms enjoyed in previous centuries are probably at best considered 'quasi-freedoms', remnants of the Grotian era of ocean exploration in both the geographic and political contexts. The key challenge in any issue relating to activities in the high seas and Area remains that of establishing the "genuine link" between State and vessel (Arico and Salpin 2005, 31).

[36] Article 87 of the Law of the Sea Convention.

Industrialised states, deep-sea researchers, and biotechnological and biopharmaceutical interests believe that freedom to access genetic resources from the high seas and Area is articulated in Part VII[37], or possibly a freedom to conduct MSR as articulated in Part XI[38] of the LOSC. A counter-argument comes from developing countries who assert that living resources (including genetic resources) found in or on the Area are the common heritage of mankind, and as such the benefits derived from genetic resources should be distributed equally to all countries (Korn, Friedrich and Feit 2003, 40). An additional argument asserts that access and conservation issues relating to genetic resources fall outside the ambit of any existing convention or customary law and therefore new international and/or regional agreements are required (Glowka 1999). An oft-cited option is to include deep-sea genetic resources in the regime of the Area, thereby rendering them the common heritage of humankind and placing exploitation activities under the authority of the ISA (Korn, Friedrich and Feit, 2003, 40-44; Arico and Salpin 2005, 60-61). Were deep seabed genetic resources to be placed under the regime of the common heritage of mankind, they would not be subject to private appropriation, could only be used for peaceful purposes, and would be managed by a global institution (Arico and Salpin 2005, 60). The advantages of such an approach are:

- The regime would cover ethical, socio-economic and environmental issues associated with deep seabed activities through the common heritage of mankind concept;
- The institutional infrastructure – the ISA – already exists and is operational;
- Management of human activities and subsequent impacts on deep seabed genetic resources and habitats would be underpinned by conservation and ecosystem management principles; and
- The existing regime includes provisions for organising and controlling exploration and exploitation activities and measures for sharing of benefits derived from deep seabed resources.

(Arico and Salpin 2005, 60).

[37] Article 87 of the Law of the Sea Convention.
[38] Article 143 of the Law of the Sea Convention.

The disadvantages, however, also raise some interesting issues and challenges such as:

- Bringing living resources within the ambit of the Area's regime and the ISA mandate would involve one of the following: (i) amendment of the Law of the Sea Convention; (ii) adoption of a Protocol; (iii) development of an Implementation Agreement; or (iv) Parties to the Law of the Sea Convention agreeing to an interpretation of the Convention that states that genetic resources found in the Area fall under the regime of either Part XI or Part VII, and which clarifies the relation between MSR and (bio)prospecting" (Arico and Salpin 2005, 60-61).
- Any of the above options will prove time-consuming and contentious as States remain divided on whether the regime of the Area and the ISA are the appropriate vehicles for addressing deep seabed living resources (and bearing in mind the mountain of challenges that arose during Part XI negotiations).
- Another salient issue noted by Arico and Salpin (2005, 61) is that while the US is not a party to the Law of the Sea Convention, it is at the forefront of deep seabed research and exploration.

(Arico and Salpin 2005, 60-61).

States are yet to adopt any measures addressing bioprospecting activities undertaken by their nationals in waters beyond the limits of national jurisdiction. Issues relating to intellectual property rights (IPRs) will also need to be resolved as current instruments[39] lack a lucid definition of what can be considered micro-organisms or resources suitable for patenting (Arico and Salpin 2005, 56). Further, Parties to the LOSC need to decide whether living resources found in the Area fall within the regime of the High Seas, and are therefore openly accessible by all, or within the regime of the Area and as such are the common heritage of mankind (Arico and Salpin 2005, 57).

[39] Current IPR instruments include the Budapest Treaty on the International Recognition of the Deposit of Micro-organisms for the Purposes of Patent Procedure, and the Agreement on Trade-Related Aspects of Intellectual Property Rights of the World Trade Organization (Arico and Salpin 2005, 56).

Mineral Extraction**:** The world's terrestrial mineral reserves are being depleted at an escalating rate and mining companies are turning their attention to the seabed and geomorphic features as potential new mineral sources for an increasingly demanding world market. It is believed that "the potential mineral resources of the seabed are, hectare for hectare, equivalent in value to mineral resources on the land" (United Nations Division for Ocean Affairs and the Law of the Sea and the International Seabed Authority 2004, 2).

Engineers and scientists have been considering the most efficient and cost-effective methods of extracting marine minerals since polymetallic nodules and marine metal sulphide deposits were first discovered. Discoveries of gold[40] and other precious metals in polymetallic massive sulphide crusts around hydrothermal vents have spurred the marine mining industry to embark on deep sea exploration and activate research and development programmes, primarily because much of the marine mineral deposits at vents "are analogues for deposits being mined on land" (Butler et al 2001, 33). India, for example, is developing a mining vehicle for extraction of polymetallic nodules at depths of up to 6000 metres (International Seabed Authority 2005a). The institution charged with managing and regulating marine mineral mining activities, the ISA, has conducted a number of workshops relating to ocean mineral exploitation and notes a trend amongst participants for engineers to design deep sea mining equipment with more regard for environmental consequences (International Seabed Authority 2005b).

Technological developments are luring mining consortiums to greater and greater depths, as was recently highlighted by the Placer Dome/Nautilus Minerals Corporation consortium[41] which used geophysics to locate polymetallic massive[42] sulphide deposits at approximately 1800 metres depth (Nautilus Minerals 2005). The consortium notes

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[40] High concentrations of gold were recently discovered in sulphide samples taken from back-arc spreading centres, including samples revealing up to 29 grams of gold per tonne of sulphide (International Seabed Authority 2005c)

[41] Placer Dome is a Vancouver-based gold mining company. Nautilus Minerals is an Australian-based marine mining company.

[42] The term *massive* "pertains to metal content rather than to size or shape of the deposit" (United Nations Division for Ocean Affairs and the Law of the Sea and the International Seabed Authority 2004, 50).

that: "...with 70 [per cent] of the earth's surface covered by oceans and relatively unexplored for minerals, this historic milestone opens up the potential for the oceans to satisfy mankind's increasing demand for metal" (Nautilus Minerals Corporation 2005). Most of Nautilus Minerals exploration has taken place in the East Manus Basin located in Papua New Guinea's archipelagic waters. The Placer/Nautilus consortium is also actively encouraging involvement of new partners in its exploration programme, particularly Asian smelter companies interested in copper and zinc deposits derived from polymetallic crusts. Nautilus Minerals believes that "Chinese and other Asian partners will be looking long term and the opportunity to learn from Nautilus and Placer's expertise in Papua New Guinea and in time apply this to international waters would be attractive to these groups" (Nautilus 2005).

Australian mining company, Neptune Resources, has recently been granted an exploration licence by the New Zealand Ministry for Economic Development to prospect for metallic and non-metallic minerals on the seafloor of the Havre Trough and Kermadec Ridge in New Zealand's exclusive economic zone (TerraNature 2005: United Nations Division for Ocean Affairs and the Law of the Sea and the International Seabed Authority 2004, 87), and has also applied for and been granted exploration leases in Japan, Micronesia and other locations (Schrope 2007, 246). A number of hydrothermal vents were discovered along the Kermadec Ridge in 1999, with mineral grab samples taken from one particular vent massive sulphide deposit containing 18 per cent zinc, 15 per cent copper, and six grams per tonne of gold (TerraNature 2005). In a similarly ambitious venture, US marine mining company Deep Sea Minerals has formed a partnership with another US mining company and commenced global exploration activities related to research and development of polymetallic sulphides (Scott 2001). The appeal of marine mining investment lies, at least in part, in the fact that mining infrastructure need not be tied to a single location as is the case with terrestrial mining – marine mining systems can be moved from location to location (International Seabed Authority 2005c). An environmental advantage is that there will be no acid mine drainage at marine mineral extraction sites (Korn, Freidrich and Freit 2003, 21), and in the legal context, “problems of tenure may be fewer and far less complex than those on land” (InterRidge 2000, 7).

Despite growing interest in deep sea mineral exploitation, determining the economic feasibility of mining polymetallic massive sulphide deposits hinges on a number of key characteristics of the deposit itself, including the geomorphology of the structures where sulphides are located, their average thickness, internal structure, diversity, and variety and content of metals in the deposit (United Nations Division for Ocean Affairs and the Law of the Sea and the International Seabed Authority 2004, 86-87). Of the 200 known deposits of seafloor polymetallic sulphides, only 11 are thought to be of sufficient size and grade to be considered for a future mining venture and of these, only two are located in the international seabed area. One of the high seas sites is located at East Pacific Rise 13°N at a depth of 2,500 metres (Herzig, Peterson and Hannington, 22-23), and the other is the active TAG hydrothermal mound which is located at a depth of 3,650 metres on the Mid-Atlantic Ridge. The Trans-Atlantic Geotraverse is one of the largest known active mineral deposits and has been actively sampled since its discovery in 1985. Researchers estimate a mass of 2.7 million tonnes of sulphide ore above the seafloor and a further 1.2 million tonnes in the underlying deposit at TAG (International Seabed Authority 2005c; Tivey 1998, 22). Large sulphide occurrences have also been found at active hydrothermal vent sites along the Mid-Atlantic Ridge, including Logatchev, Snakepit, Broken Spur, Lucky Strike and Menez Gwen; and at the Sonne Field hydrothermal vent field on the Central Indian Ridge (Herzig, Peterson and Hannington, 11), although it is unclear whether these sites will be the focus of future mining efforts.

The favoured geological location for polymetallic sulphides is submerged volcanic mountain ranges at the divergent plate boundaries which form the planet’s mid-ocean ridge system. Of the approximately 60,000 kilometres of mid-ocean ridges circling the globe, 80 per cent wind along the international seabed area (United Nations Division for Ocean Affairs and the Law of the Sea and the International Seabed Authority 2004, 87). This information implies that there may be many more massive sulphide deposits and potential mining ‘bonanzas’ waiting to be discovered along the mid-ocean ridges of the

Area. Seafloor massive sulphide mining will initially be concentrated in relatively small areas and will be in the form of either strip mining (surface mining) or open cast mining (shallow subsurface mining) enabling operators to “recover sulphide mounds and chimney fields at the seafloor and replacement ore bodies in the stockwork zone just below it” (International Seabed Authority 2005c).

Empirical evidence suggests that actively venting hydrothermal fields containing polymetallic massive sulphide deposits are usually no bigger than a sports stadium and as such would be highly sensitive to disruption by sampling, drilling, and appropriation of minerals or microbes (United Nations Division for Ocean Affairs and the Law of the Sea and the International Seabed Authority 2004, 68). There are, however, exploration methods being developed to locate polymetallic massive sulphide deposits at inactive venting sites, that is, vents which are no longer pluming and which do not have the endemic and specialised chemosynthetic fauna or unique ecosystems that existed during the formation of these deposits (International Seabed Authority 2005c). Anecdotal evidence suggests inactive deposits are colonised by ‘normal’ deep-sea organisms. Nonetheless, some researchers are calling for confirmation of this evidence prior to commencement of mining activity at inactive polymetallic massive sulphide deposits (InterRidge Workshop 2000, 7-8).

As deep-sea mining of polymetallic massive sulphides moves from ambition to reality, it is yet to be determined how active vent sites might recover from the impacts of mining activity. Much depends on the geology of the site. For instance, in fast spreading ridges such as the East Pacific Rise, hydrothermal sites are ephemeral and species appear to be well-adapted to this characteristic with evidence suggesting that vent species are quick to colonise the rapidly forming new vent chimneys (Baker et al 2001, 19). The impact of mining activities, however, may be greater at slow spreading ridges such as the Mid-Atlantic where vents are older and more stable and where vent species, many of them possibly ‘mother’ populations, have adapted to the comparatively non-ephemeral nature of these habitats. Large massive sulphide deposits are found primarily along these slow spreading ridges (Tunnicliffe et al 1998, in Baker et al 2001, 19). It is believed that mining activity at active hydrothermal vent sites:

> …will result in removal of the substratum and production of plume. Some organisms will be killed directly by mining machinery, while others risk smothering by material settling from the plume. Individuals surviving these perturbations will be subject to a radical change in habitat conditions with hard substrata being replaced by soft particulates settling from the mining plume. These particulates could also clog hydrothermal conduits, depriving established vent communities of their vital fluid supply. Removal of sections of the sulphide deposits will also change the subsurface hydrology beneath the vent systems, possibly decreasing or stopping hydrothermal fluid flow to remaining vents. At sediment covered hydrothermal sites where much of the ore body lies…digging out the deposit would produce a much more extensive plume that could completely eradicate the local vent fauna (Juniper 2001, 94).

To counter environmental concerns about polymetallic massive sulphide mining around hydrothermal vent systems, Nautilus Mineral Corporation intends to set aside sections of fields in its "Greece-sized lease area" as preservation areas so that comparisons can be made between mined and unmined sites (Schrope 2007, 247).

Regulatory Instruments and Measures Relevant to Marine Mining***:*** The ISA controls the resource appropriation activities of nation-states in the international seabed area. *Resources*, in the context of the Area, are "all solid, liquid or gaseous mineral resources" which are referred to as 'minerals' only upon recovery[43]. In other words, the ISA's control extends only to anthropogenic activities relating to non-living resources found on the international seabed, ocean floor and subsoil, all of which are vested in the common heritage of humankind[44] on whose behalf the Authority acts[45] (United Nations Division for Ocean Affairs and the International Seabed Authority 2004, 8). The Authority is obliged to adopt appropriate rules, procedures and regulations to prevent damage to the fauna and flora of the marine environment.[46] The ISA also has a commercial arm known as the Enterprise which enables the Authority to engage in seabed mining in its own right. The Enterprise is obliged to develop rules to implement the deep seabed

[43] Article 133 of the 1982 Law of the Sea Convention (United Nations Division for Ocean Affairs and the International Seabed Authority 2005, 8).
[44] Article 136 of the Law of the Sea Convention.
[45] Article 140 of the Law of the Sea Convention.
[46] Article 145(b) of the Law of the Sea Convention.

mining regime established by Part XI of the Law of the Sea Convention (Korn, Freidrich and Feit 2003, 29).

Although not yet completed, the ISA is developing a *Mining Code* comprising a suite of rules and procedures to regulate prospecting, exploration and exploitation of marine minerals in the Area. This body of rules, regulations and procedures will be issued within the legal framework established by the 1982 Law of the Sea Convention and its 1994 Implementing Agreement relating to deep seabed mining activities. The *Mining Code* includes the previously issued Rules and Regulations on Prospecting and Exploration for Polymetallic Nodules (adopted in 2000), and the ISA is currently developing a raft of regulations, rules and procedures for prospecting and exploration of cobalt crusts and polymetallic sulphides for inclusion in the Code. Importantly, the *Mining Code* will include recommendations to guide contractors on assessments of the environmental impacts of prospecting, exploration and exploitation of marine minerals (International Seabed Authority 2007g).

The International Marine Minerals Society (IMMS), a global organisation with members from industry, government agencies, and academic institutions, adopted a *Code for Environmental Management of Marine Mining* in 2001 following extensive consultation with members. The IMMS Code presents a statement of Environmental Principles for the marine mining industry and a set of Operating Guidelines intended for application at specific mining sites, both of which set broad directions rather than being prescriptive. The Guidelines function as benchmarks for environmental management strategies for stakeholders at sites that are the focus of exploration and resource extraction (International Marine Minerals Society 2001; 2009). The Code is intended to be an organic document and is reviewed every five years after consultation with the marine mining industry and other stakeholders involved in marine mining (International Seabed Authority 2009).

By adopting the IMMS Code of Conduct Principles, marine mining companies are committed to the following principles:

- To observe the laws and policies and respect the aspirations of sovereign states and their regional sub-divisions, and of international law, as appropriate to underwater mineral developments.
- To apply best practical procedures for environmental and resource protection, with consideration for future developments within the area which might be affected;
- To consider environmental implications and observe the precautionary principle at all stages of a marine mining project, from exploration to closure and post closure monitoring;
- To liaise with stakeholders and facilitate community partnerships on environmental matters throughout the project's life cycle;
- To maintain an environmental quality review programme and deliver on commitments and
- To report publicly on environmental performance and implementation of the Code

(I International Marine Minerals Society 2009).

The Code's Operating Guidelines address in detail the following issues:

- Responsible and sustainable development
- Develop an environmentally responsible company ethic
- Community partnerships through consultation
- Environmental site-specific risk management
- Integrated environmental management as a company priority
- Company environmental performance targets
- Review, improvement and updating of environmental policies and standards
- Rehabilitation and decommissioning
- Reporting and documentation
- Environmental data collection, exchange and archiving
- Performance reviews by qualified, externally-accredited environmental auditors, preferably every three years.

(I International Marine Minerals Society 2001).

Energy/Geothermal Exploitation***:*** There have been expressions of interest regarding the large-scale harnessing of energy from hydrothermal vent fluids. Potential impacts from geothermal exploitation of this nature include reduction of the flow of hydrothermal fluids to natural outlets, including those that support vent fauna, which may result in premature ageing of vent sites (InterRidge 2000, 8).

Conclusion

Even though very little of the deep ocean floor has been biologically investigated (Baker et al 2001, 5), this chapter has provided an overview of known significant and ecologically critical types of geomorphic features found in the deep ocean and the spectacular variety of habitat types and species these features host. The geomorphology, geology, life forms, and current and potential threats to seamounts, deep sea coral communities, deep sea trenches, polymetallic nodules, cold seeps and pockmarks, submarine canyons and hydrothermal vent systems have been described, as well as the regulatory instruments and measures developed and implemented to afford some form of protection to these features.

This chapter has focused on the biology, ecology, geology, geomorphology and current and future threats to hydrothermal vent systems because the author is of the view that a hydrothermal vent system or field is an excellent candidate for the world's first high seas marine protected area prototype. Vent systems are, for the most part, ephemeral pristine deep sea ecosystems with a critical role in the chemical composition of the oceans. They are isolated biological islands with highly specialised fauna which have adapted to extreme physical and chemical conditions. Some vent species have developed remarkable and idiosyncratic symbiotic or 'cospeciation' relationships, and as such are invaluable novels in the world's genetic 'library'. Indeed, vent system species have inspired new theories on the origins of life on Earth and possibly on other planets. They are charismatic geomorphic features, ideal subjects for raising awareness about the world's deepest oceans and what lies within through the medium of communication technologies.

Although not addressed in this chapter, arguments for and against designation of several of the geomorphic features as high seas marine protected areas have been made. For instance, there is a great deal of international concern about the damage inflicted by bottom trawling to seamounts and cold water coral communities which teem with valuable commercial fishstocks. While a sound ecological case can be mounted for internationally agreed protection of seamounts and cold water corals, political and commercial realities indicate that these deep ocean habitats may not be ideal candidates for the world's first high seas marine protected areas. Arguably, declaring a pristine seamount environment the world's first high seas marine protected area prototype would alert illegal, unregulated and unreported (IUU) fishers, or fishers with flags of convenience to healthy populations of commercial fishstocks and the prospect of significant commercial gain.

Further, as regional fisheries management organisations (RFMOs) increase the protection of geomorphic features located in the high seas regions of their areas of responsibility – timely considering fishing is considered the primary impact on the ecological health of these deep ocean features – we may find these initiatives circumvent the need for international arrangements to implement marine protected areas. Deep sea fisheries are dominated by bottom trawlers, with the main target species being prawns, orange roughy, redfish, oreos, alfonsinos and grenadiers (Pauly et al 2003). Longliners target Patagonian toothfish in the Southern Ocean, while bottom gillnet fisheries target deep water sharks and monkfish. A high percentage of deep sea fishing is undertaken illegally, and is therefore unreported and unregulated (IUU) (United Nations Environmental Program 2007, 34). A designated marine protected area would do little if anything to deter IUU fishing. Indeed, as demonstrated with high seas seamount MPAs, it may have unintended consequences.

On the balance of evidence regarding current and future threats; ecosystem properties; levels of endemicity; ecosystem functions, goods and services; and political realities, a hydrothermal vent system is the ideal prototype for spatially demarcated protection of geomorphic features located in areas beyond national jurisdiction. As such, the section on hydrothermal vents in this chapter provided extensive details on their geology, geomorphology, biology, current and potential threats, and extant regulatory instruments and measures intended to conserve and/or protect. This is to support the argument made in Chapter Seven that a hydrothermal vent system is an excellent candidate for the world's first high seas marine protected area prototype. Before we embark on the prototyping journey, however, we need to examine the governance system in which a high seas MPA would 'fit' or be 'nested'. Because there is no controlling, centralised, authoritative body making oceans management decisions on behalf of its global constituents (nation-states), the most appropriate systems view of global oceans governance is that of the complex adaptive systems (*cas*) paradigm. As will be explained in Chapter 3 Three, global oceans governance exhibits the four cornerstones *of cas – adaptation*, *emergence*, *self-organisation*, and *hierarchy* (Holland 1995). The *cas* paradigm paints a colourful backdrop and provides a suite of metaphors for analysis of high seas MPA discourse and its key agent, the high seas epistemic community.

CHAPTER THREE

THE COMPLEX ADAPTIVE SYSTEMS PARADIGM AND ITS VALUE FOR EXPLAINING HIGH SEAS MARINE PROTECTED AREA DISCOURSE AND THE GLOBAL OCEANS GOVERNANCE SYSTEM

Introduction

The global oceans governance system, that is, the vast array of instruments, agreements, measures, institutions, regimes, initiatives and agents devoted to oceans management domestically, regionally and globally, is driven by the dual priority social goals of ensuring that the resources appropriated from the oceans and seas remain available and sustainable, and that as little harm as possible is inflicted on the marine environment. These goals are not mutually exclusive. Whether this vast array of agents and rules will achieve these objectives is questionable, however the priority social goals have been established and the system within which they operate is described in this chapter as a complex adaptive system (*cas*)[47]. This is because the *cas* paradigm describes the dynamic processes on a scale determinative of these priority social goals.

One of the tools identified to achieve the goal of inflicting as little harm as possible on the marine environment beyond coastal state jurisdiction, that is, in the deep oceans and seabed known as the high seas and Area respectively, is the marine protected area. This chapter provides the paradigmatical and metaphorical framework within which to examine the concept of high seas marine protected areas, the way in which the high seas epistemic community frames its arguments for their creation (high seas MPA discourse), and the 'fit' of discourse and community in the global oceans governance system. The complex adaptive systems paradigm contributes toward an even deeper understanding of the 'fit' of concepts such as high seas marine protected areas in global oceans governance.

[47] Holland (1995) italicises the *cas* acronym so I am following suit.

\In the words of François Jacob (1977, 1161): "Whether mythic or scientific, the view of the world that man constructs is always largely a product of imagination." The concept of *systems* is no exception: they are a human construct borne of our imaginations, a means by which we can explain a part or parts of our universe.

While a simple description of a system involves two or more interacting components surrounded by an environment in which it may or may not interact (O'Neill et al 1986, 38), "the *best* description of a system", according to Norton and Ulanowicz, "is one that describes dynamic processes on a scale determinative of priority social goals" (1992, 244, emphasis added).

Global oceans governance is a system exhibiting the four cornerstones of the *cas* paradigm – *adaptation*, *emergence*, *self-organisation*, and *hierarchy* (Holland 1995). It is an *emergent* and *self organised* phenomenon *adapting* to new demands and pressures as new knowledge about the state of deep ocean habitats and marine biological diversity and geology becomes available. It is also *hierarchically organised* at multiple levels as the magnitude and scope of various challenges increases and agents attempt to find and implement solutions in domestic, regional and international contexts.

The High Seas Epistemic Community

Nested within this global oceans governance *cas* is a high seas epistemic community campaigning for a legally binding framework of instruments and initiatives to protect the biodiversity of marine ecosystems beyond national jurisdiction. It is one of many in a constellation of agents circulating within global oceans governance arena.

An *epistemic community* is defined as "a network of professionals with recognised expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain or issue area" (Haas 1989). The high seas epistemic community is embedded within the larger global oceans governance *cas* and comprises representatives from domestic government agencies, academia, scientific research institutions, international and regional organisations and institutions, and global non-government environmental organisations and coalitions who together are exploring ways of achieving their common goal – the conservation and protection of high seas biodiversity. The high seas epistemic community comprises a core group of members who for the most part have stayed the course primarily through their membership of, or affiliation with international environmental non-government organisations and global environmental trust funds and their commitment to the priority social goal of ensuring protection for all oceans biodiversity.

A key tool in the high seas epistemic community's conservation kit is the marine protected area. The discourse taking place within the high seas epistemic community indicates that one of its priority social goals is that of *a global representative system of marine protected areas by 2012*. The temporally finite intention of this social goal implies a means to an end – as discussed throughout this thesis, the high seas epistemic community's primary aim has been framed in terms of achieving a globally representative system of MPAs by 2012. Marine protected area proponents envisage this goal making a significant contribution toward protecting marine habitats and resources in the high seas and Area and an 'invaluable' addition to an already extensive suite of tools premised on conservation and/or protection of high seas biodiversity in the complex adaptive system that is oceans governance. The extent of this suite of tools is demonstrated in Appendix 1, nevertheless, the high seas epistemic community's campaign is driven by the perception that to protect ocean biodiversity, spatial management tools such as MPAs are critical. As described in Chapter's Four and Five, the high seas epistemic community is one agent among many in a complex adaptive system hosting multiple dynamic and divergent views and goals.

The high seas epistemic community is an *agent* in the global oceans governance *cas* that is interacting with other agents within the system. High seas MPA discourse is examined in greater detail in Chapters Four and Five. Chapter Five in particular demonstrates the depth of influence of the high seas epistemic community in international fora addressing the protection of oceans biodiversity. As will be argued in the Chapter Six, many within the high seas epistemic community have assumed a linear approach to the concept of high seas MPAs by advocating their creation in the context of the 2002 World Summit on Sustainable Development (WSSD) agreement for a global representative network of MPAs to be achieved by 2012.

At the heart of this research project is the question of whether high seas marine protected areas are indeed ‘an idea whose time has come’ and if so, how they might be achieved. Are they necessary when there is already a significant and growing body of international conventions, regulations, instruments, and formal and informal agreements ranging from bilateral, to regional and global which are designed to conserve and protect elements of high seas biodiversity and geomorphic features? Is *a global representative system of MPAs by 2012*, as advocated by the high seas epistemic community, a pragmatic, realistic and achievable goal? Is a global system of MPAs needed? Do we need another consensually achieved, legally binding agreement to cement the place of high seas MPAs in international law or might there be other means of testing the political will of nation states directly involved in activities in the high seas and Area? These primary questions are best addressed by analysing them within the frame of the complex adaptive systems paradigm, and employing the four characteristics and seven basic elements of *cas* as metaphors for deeper examination of the high seas epistemic community’s approach to the creation of high seas MPAs. This chapter represents a journey through the *cas* paradigm and its attendant metaphors in order to explain why this is being used as the backdrop for deeper analysis of the high seas epistemic community’s approach to the protection of deep oceans biodiversity.

Complexity and Complex Adaptive Systems

Overview

The complex adaptive systems (*cas*) paradigm is a synthesis of ideas and principles which have emerged from an eclectic mix of disciplines including, *inter alia*, physics, sociology, political science, economics, mathematics, psychology, philosophy, physiology, biology, and computer sciences (Waldrop 1992). The fundamentals of the *cas* paradigm – four characteristics and seven basics – describe a set of metaphorical tools which are useful for examining and analysing the concept of high seas MPAs, how and if they might 'fit' in the current global oceans governance regime; how the high seas epistemic community itself 'fits' into the global oceans governance *cas*; and why the primary agents in the high seas epistemic community remain determined to drive the concept and its scope in a preferred direction.

The *cas* paradigm stands in strong contrast to the steady state and near-equilibrium theories that have influenced development of environmental science, policy, and conservation-based management in developed countries over the course of the 20th century (Gunderson et al 1995). The popular steady state/equilibrium paradigm is embraced by those who believe that a 'state of balance' between nature and human society is both highly desirable and necessary. The view that nature thrives best when in, or close to, a state of balance and harmony is articulated in domestic natural resource policies crafted by bureaucrats, mirrored in the rhetoric of ecosystem management plans, revered in the bulk of current sustainable development literature, and analysed and dissected in environmental ethics discourse. This dominant paradigm has been generated by institutions and organisations devoted to the reformation of global resource policies and environmental management such as the Brundtland Commission, the International Institute for Sustainable Development, and the World Resources Institute (Holling, Gunderson and Ludwig 2002), and well-funded global environmental non-government organisations such as the IUCN, Greenpeace and WWF. The influence of these institutions on international and domestic policy agendas drives the chimera that in an ideal world, 'nature', of which human societies are a part, functions best in a state of near-equilibrium. In stark contrast to the steady state/near-equilibrium paradigm, *cas* scholars and practitioners view the world as a dynamic whole made up of a hierarchy of systems that demonstrate "…the complex non-linear relation between entities under *continuous* change and facing discontinuities and uncertainty from complexes or suites of synergistic stresses and shocks" (Folke et al 2002, 16, emphasis added). There are no aspirations for an equilibrium Utopia in the complex adaptive system literature.

Although *cas* as a field of study is primarily a 20th century phenomenon, scholars have been tinkering with two of its fundamental characteristics since the 18th century – *self-*

organisation and *emergence*. Biologists, economists and political scientists began exploring the concept of emergent and spontaneous organisation during the period known as the Enlightenment, thereby creating a niche for *cas* research, a field which has evolved into a paradigm over the centuries. What continues to make the concept of complex adaptive systems challenging, intriguing, and curiously appealing is its inherent level of abstraction, as described by Cilliers:

> Because complexity results from the interaction between the components of a system, complexity is manifested at the level of the system itself. There is neither something at the level below (a source), nor at the level above (a meta-description), capable of capturing the essence of complexity (1998, 20).

The exploration of *cas* presented in this chapter is preceded by two caveats. The first is that as there is no single generic complex adaptive systems theory (Ostrom 1999, 521), and the second is that *cas* scholars are yet to agree upon a formal definition (Levin 1999, 12). Indeed, one could argue that attempting to construct a general *cas* theory would contradict the most fundamental lesson that complexity scholars have thus far imparted – that the nature of the complexity beast is such that a formal or orthodox definition is impossible.

The Value of Metaphors

Inquiry, research and analysis of complex adaptive systems require a fertile imagination and a comfortable relationship with metaphors. While the literature is absent a universally agreed definition, there are approximations of what the *cas* concept represents. The most pragmatic and therefore appealing of these approximations was penned by Herbert Simon, who captured the essence of complex adaptive systems thinking by *describing cas* as:

> … one made up of a large number of parts that interact in a non-simple way. In such systems, the whole is more than the sum of its parts, not in an ultimate, metaphysical sense, but in the important pragmatic sense that, given the properties of the parts and the law of their interaction, it is not a trivial matter to infer the properties of the whole. In the face of complexity, an in-principle reductionist may be at the same time a pragmatic holist (Simon 1962, 468).

One of several universal themes in descriptions of complex adaptive systems is that basic components and laws (rules) interact more or less simultaneously within the self-organised complex adaptive system and that multiple options for interaction are also presented by the system itself (Waldrop 1992, 86). Although consensus about the characteristics, properties and mechanisms of *cas* has largely been achieved, the emergence of complex adaptive systems as a research discipline remains dynamic, reflecting the perpetual novelty of the *cas* phenomenon under examination.

In acknowledging that social and natural systems are both complex and adaptive, and in order to explain the *cas* phenomena, the use of metaphors is critical. Identifying and expanding the parallels between different forms of *cas* encourages us to note similarities between non-identical objects or situations which can be perceived as the same at some abstract level (Pavard and Dugdale 2005). In a similar vein, Black explains that successful use of metaphors works by:

> …. applying to the principal subject (target) a system of "associated implications" characteristic of the subsidiary subject (source) …. These implications usually consist of "commonplaces" about the subsidiary subject, but may, in suitable cases, consist of deviant implications established ad hoc by the writer…. The metaphor selects, emphasises, suppresses, and organizes features of the principal subject by implying statements about it that normally apply to the subsidiary subject (Black 1962).

Contemporary physical and social science discourse has established "an equitable relationship with metaphors, those fundamental tools of the imagination" (Lopez 1986, 250). Nonetheless, there still exist adherents to the 'old science'; those disciples of traditionalism (namely, reductionists and 'linearists') who resist the power of narrative and as such, stand accused of being:

> …so bound by rational analysis, or so wary of metaphor, that they recognise and denounce anthropomorphism as a kind of intellectual cancer instead of employing it as a tool of comparative inquiry, which is perhaps the only way the mind works, that parallelism we finally call narrative (Lopez 1986, 250).

Metaphors supply oxygen to narratives of the system or systems we are exploring. Exploring complexity encourages a sense of adventure and experimentation. The *cas* tools – the four characteristics and seven basic properties and mechanisms – are relatively new, unorthodox, and exciting because the writer can include "deviant implications" (Black 1962) when applying the *cas* metaphors.

Metaphors prove time and again to be highly useful mechanisms for explaining phenomena to boundedly rational beings[48]. Metaphors are ‘building blocks’, and the building block, as explained in this chapter, is a mechanism of *cas*. The building block mechanism exists because of our need to decompose complex scenes into discernable parts so that we can improve our understanding. Our cognitive limitations compel us to reduce the number of variables to those that are the most relevant while simultaneously acknowledging the complexity of the system under investigation. From this vantage point we can study the system in a controlled way and derive models from simpler representations without losing the system’s key properties, as depicted in Table 1.

Table 4: Examples of Complex Systems Models (adapted from the Centre for the Study of Complex Systems 2005)

Field	**Economics**	**Ecology**
Agent	Consumers	Individual animals
Heterogeneity	Tastes, incomes	Eating, reproduction habits
Organisation	Families, businesses	Herds, schools, trophic chains
Adaptation	Education, affects of advertising	Hunting, shelter, safety
Feedback	Buying, selling, trading	Success or failure
Dynamics	Price adjustments	Prey-predator interactions, competition, cooperation
Emergent behaviour	Inflation, unemployment	Extinction, niches

What underpins analysis of any *cas* is the extent to which we can abstract microscopic interactions in order to understand macroscopic behaviours (Levin 1999, 107; Pavard and Dugdale 2005). The four characteristics and seven ‘basics’ (properties and mechanisms) that identify complex adaptive systems (as devised by Holland 1995) are the most useful tools for the task of dissecting the concept of high seas MPAs as

[48] Herbert Simon recognised the cognitive limits to the decision maker’s ability to consider all known options, which forces them to selectively consider alternatives. He named this phenomenon the *bounded rationality model*. Because of our cognitive limitations, it is likely decision makers choose from options selected on ideological or political grounds, if not randomly, then without reference to their implications for efficiency. In practice, decisions do not maximise benefits over costs, rather they satisfy whatever criteria decision makers set for themselves in relation to the instance in question. This ‘satisfycing’ criterion, as Simon called it, was a realistic one given the bounded rationality with which humans are capable (Howlett and Ramesh 1995, 141).

promoted by the high seas epistemic community, and the 'fit' of this community within the global oceans governance *cas*.

The Four Characteristics of Complex Adaptive Systems

Although a single all encompassing definition of a complex adaptive system does not (cannot) exist, complexity scholars agree that complex adaptive systems are defined by four substantive characteristics – (i) *adaptation*; (ii) *emergence*; (iii) *self-organisation*; and (iv) *hierarchical organisation*.

Adaptation

According to Holland, "adaptation is the sine qua non of *cas*" (1995, 8). Complex adaptive systems have the capacity to learn and therefore adapt (Holland 1995, 8-9). The capacity to adapt is what keeps the system 'alive'. Adaptation is experiential, in other words, experience influences changes in an agent's structure so that over time it manipulates its environment for its own ends – it improves its environmental *fitness*. Because the system's agents are constantly adapting, the system itself is constantly adapting, albeit at a much slower pace. To demonstrate this point, Table 2 provides a simple but effective list of examples of the adaptive process in selected complex adaptive system types and the adaptation timeframes of each.

In its conventional form, *fitness* is a biological term referring to: "…the measure of the survival and reproductive success of an organism or type of organism" (Levin 1999, 233). Complex adaptive systems theorists, however, have extended the concept of adaptation and fitness beyond its biological context to encompass all types of activities and forms of agents within a *cas*, as well as to the *cas* itself.

The environment of any given adaptive agent is dominated by other adaptive agents so that "a portion of any agent's efforts at adaptation is spent adapting to other adaptive agents" (Holland 1995, 10). Waldrop demonstrates this in his example of frog and fly coevolution:

> If the frog evolves a longer tongue…the fly has to learn how to make a faster getaway. If the fly evolves a chemical to make itself taste ghastly, the frog has to learn how to tolerate that taste…At any given instant, the frog will find that some strategies will work better than others. So at any given instant, the set of all strategies available to the frog forms a kind of imaginary landscape of 'fitness', with the most useful strategies being at the peaks and the least useful being somewhere down in the valleys. As the frog evolves, moreover, it moves around the landscape (Waldrop 1992, 310).

Adaptation and associated adaptive behaviours are "a major source of the complex temporal patterns that *cas* generate" (Holland 1995, 10). By exploring and understanding these ever-changing patterns, we improve our understanding of the particular *cas* under examination. We also learn to adapt our strategies to maintain or improve our fitness in the system. Failure to adapt means failure to survive.

Table 5: System Type and Experience - Adaptation Timeframes (adapted from Holland 1995, 9)

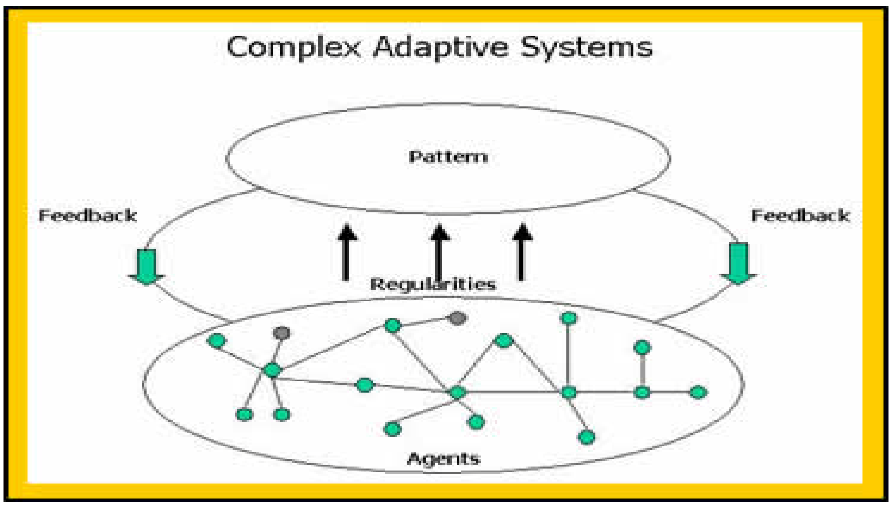
System		**Modification Time**
Central nervous systems	→	seconds to hours
Immune systems	→	hours to days
Business	→	months to years
Species	→	days to centuries
Ecosystem	→	years to millennia

Emergence

All complex adaptive systems are *emergent* systems. Behavioural patterns, system properties, and coherent structures emerge from the interactions between agents and between subsystems within the *cas*. The physiology of a *cas* can be understood by exploring the connectivity – the relationships – between its parts rather than analysing each part in isolation (Gallagher and Appenzeller 1999, 79). Over time, these patterns of interactions manifest in emergent phenomena that are observable at the macro-scale even though they are generated by agents at the micro-level (Seel 1999, 2; Pavard and Dugdale 2005). This process is depicted in simple fashion in Figure 1.

The agents of a system operate according to a basic set of behavioural rules, and yet the emergent behaviour that manifests in the system itself far exceeds the individual capabilities of each of its agents. Not all complex behaviours have complex roots; a relatively brief inventory of rules may generate complex behaviours. The phenomenon of emergent behaviour underlines the *cas* maxim that a whole complex adaptive system cannot be depicted by simply adding up its parts (Holland 1998, 5) because the system is in a constant state of flux.

Figure 3: Complex Adaptive Systems (Reproduced with permission of P. Fryer 2005)



A system composed of simple parts that exhibit complex behaviours is described as one of *emergent complexity*. This notion is best demonstrated by contrasting it with *emergent simplicity*, an example being that of the Earth orbiting the sun. While the Earth is a complex adaptive system, its behaviour as a whole is quite simple. The behaviours of its parts do not determine the behaviour of the whole because the whole exhibits a behavioural pattern that is distinctly different from the diverse behaviours of its parts (Bar-Yam 1997, 5). The Earth still orbits the sun every 24 hours irrespective of what is occurring on it.

Emergent complexity arises because the behavioural patterns of the whole system can and do change according to the behaviours of system agents. It is difficult if not impossible to understand the dynamics of behavioural patterns of the whole from the behaviours of its parts – *cas* cannot be explained by analysing the parts in isolation and then simply adding them up. In order to understand system behaviours, *cas* scholars identify leverage points within the system that have contributed to large, directed changes of the system as a whole (Holland 1995, 39; Bar-Yam 1997, 10).

Self-organisation

One of the most fascinating and mysterious aspects of the *cas* characteristic of emergence is the capacity for *self-organisation*, that is, for patterns of behaviour to emerge out of interactions and relationships between agents absent an endogenous, centralised command system and without any exogenous control, coordination or design (Seel 1999, 6).

Self organisation enables complex adaptive systems to be self-supportive and adapt to new circumstances in creative ways. This creativity is reflected in, for example, the capacity of natural systems to be resilient to, or to rebound from, the effects of heavy resource exploitation or the impact of anthropogenic pollution (Norton and Ulanowicz 1992, 247), unless of course the impacts are such that the system is tipped 'over the edge' and into oblivion.

Self-organisation allows the complex adaptive system to accommodate a multitude of diverse structures and phenomena that would otherwise overwhelm its chances of survival. If a system is to continue to be self-organising, its functions must co-evolve so that it can respond continuously to the demands of its environment. Because environmental demands are dynamic, *cas* can never achieve a state of stasis or near-equilibrium[49] (Norton and Ulanowicz 1992, 247; Pavard and Dugdale 2005).

[49] Some complex systems scholars hypothesise that *cas*, particularly ecological *cas*, balance on the edge of order and chaos. The 'edge of chaos' is a place where the system itself is stable enough to store information for system sustenance and yet also sufficiently ephemeral to allow for the transmission of information between agents and between multiple subsystems contained within the *cas*. According to 'edge-of-chaos' theory, a thin membrane bounds systems where particular behaviours occur, an example being the density of the boundary between the ocean surface and air above- just one particle thick and yet this infinitesimally thin 'skin' separates two completely distinct, although not mutually exclusive, complex adaptive systems (Waldrop 1992, 293-95). According to 'edge of chaos' theory, the capacity of

Two principles which underline the *cas* characteristic of self-organisation are: (i) even a small number of rules can generate systems of remarkable complexity (Holland 1998, 3); and (ii) that control is poly- rather than unicentric. Polycentricity is a primary definitional rule of the complex adaptive systems paradigm and examples of dispersed control abound within *cas*. There is no master neuron that controls the functions of the brain nor is there a central control mechanism or master commander in an economy. Likewise, there is no world government or similar to manage human interactions with the oceans on a global scale, and yet a global oceans governance *cas* has emerged and self-organised over several centuries. These examples demonstrate the efficiencies that self-organised complex adaptive systems can realise through manifold, interdependent, and complementary actions, interactions and adaptations between agents and between multiple subsystems at multiple scales (Waldrop 1992, 145; Levin 1999). In other words, solutions to problems and challenges cannot be imposed on a *cas*; instead they emerge from interactions between system components that are following a basic set of rules (Briassoulis 2004, 7).

Hierarchical Organisation

The multiple levels of organisation inherent in *cas* 'structures' are referred to in the *cas* literature as *hierarchical* organisation. Theories of hierarchical organisation are essentially theories of observation of scale, the latter being "the spatial extent, time, momentum, duration and energy of a behaviour" (Bar-Yam 2005, 5). Like the term *system*, a *hierarchy* is a conceptual tool forged by our need to perceive, categorise, and analyse. As such, viewing *cas* as a system of hierarchically organised levels offers "a very general organizational frame" (Allen and Starr 1982, 16).

Conventional definitions of *hierarchy* refer to formal arrangements whereby an agent is positioned at the apex of an organisation and from this superior position exercises authority and control over the activities and interactions of subordinates (Simon 1962,

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cas to self-organise and function absent centralised control enables 'orderly' patterns of behaviour to arise out of relationships and interactions between constituent agents even though the system hovers on the edge of chaos (Seel 1999, 6; Waldrop 1992, 295).

468). In the context of *cas* hierarchies, however, there is no indication that ‘higher’ levels dominate and control ‘lower’ levels of the system. In contrast to the conventional definition, *cas* hierarchies are composed of interrelated subsystems nested at higher and higher levels (Simon 1962, 468). Agent behaviours are aggregated and classified according to rates of agent interaction. If these aggregates are sufficiently distinct, the system is considered hierarchical because the “structure imposed by differences in rates [of interaction] is sufficient to decompose a complex system into organizational levels and into discrete components within each level” (Overton 1974 in O’Neill et al 1986, 76).

Figure 2 demonstrates in simple form the hierarchical organisation of a *cas*, the strength of connections that occur within an aggregate/subsystem, and the connections between subsystems and between levels of the hierarchy. The broken lines depict less frequent connections while the bold lines indicate strong and frequent interactions, indicating that the greatest strengths are internal to the subsystem.

Partitions and subsystems are delineated subjectively in order to identify the elementary units in any specific complex system hierarchy – to reiterate earlier observations, hierarchical organisation is a process driven by the subject and context of a particular investigation (Simon 1962, 468). The boundaries of agents, aggregates, and the *cas* itself can be demarcated according to the investigator’s needs relative to the issue or problem at hand, the analytical context, and the investigator’s prejudices rather than on any intrinsic property of the system itself (Seel 1999, 3). Margalef, for instance, noted that: “everywhere in nature we…draw arbitrary surfaces and arbitrarily declare them boundaries separating two subsystems” (1968, in Allen and Starr 1982, 10). In contemporary environmental discourse, the ecosystem-based approach encapsulates the arbitrary nature of natural resource management and the desire to demarcate boundaries to define, prove or promote a particular point.

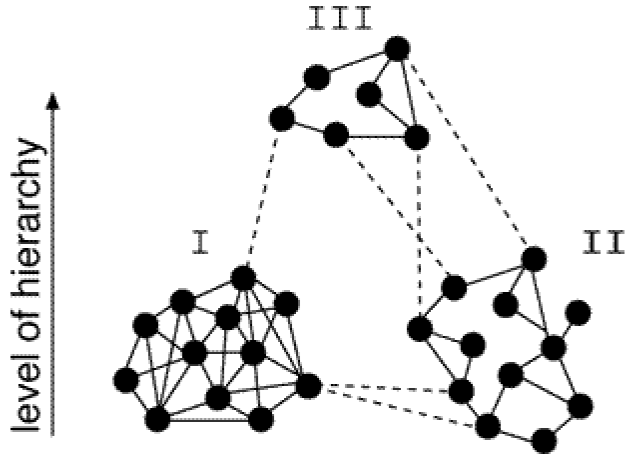
It is also important that the investigator define and classify the system relative to the scale of the problem being addressed (O’Neill et al 1986, 85). To reiterate the wisdom of Norton and Ulanowicz (1992, 244), “the best description of a system is one that describes dynamic processes on a scale determinative of priority social goals”. Because of the arbitrary nature of complex systems analyses, our perception of them as hierarchically organised systems is at best a caricature of the real thing. This is illustrated by Pimm in his influential study of food webs and his observation that:

> ...[f]ood webs are diagrams depicting which species in a community interact. They depict binary relationships – whether species interact or not – and miss much important biology. In the real world, species interactions change at least seasonally and not all interactions are equally strong. Food webs are thus caricatures of nature. Like caricatures, though their representation is distorted, there is enough truth to permit a study of some of the features they represent (Pimm 1982, in Golley 1993, 191).

Defining vertical rates of interaction reveals the nested hierarchy – the higher levels are composed of and contain the lower levels, and each level can be segregated on the basis of response or reaction times (O’Neill et al 1986, 76). A primary determinant of the hierarchical organisation of *cas* is the distinction between high and low frequency interactions that link agents and levels; the investigator needs to explore interactions *between* subsystems (long run) and interactions of agents *within* subsystems (short run) to identify system behaviours (Simon 1962, 473).

Investigating the frequency of interactions between agents necessitates investigation of the system’s topology, that is, the rates of connectivity and interactivity (space-time relationships) between agents and aggregates of agents both laterally and vertically. *Vertical hierarchical organisation* refers to the nesting of subsystems into higher and higher levels of organisation (O’Neill et al 1986, 76-79). *Lateral hierarchical organisation* refers to the frequency of interaction of the components within a subsystem, between subsystems, and across the same level (O’Neill et al 1986, 79). Lower organisational levels exhibit rapid rates of interaction (lateral high frequency) while behaviour corresponding to higher levels occurs at much slower rates (vertical low frequency). In Figure 4, lateral high frequency interaction is depicted as bold lines, while vertical lower frequency interaction is represented by broken lines.

Figure 4: Hierarchical organisation of *cas* (Resilience Alliance 2003).



Within levels we find rapid rates of interaction, transaction, and response times between agents thereby fuelling innovation, experimentation and adaptation, or 'short run behaviours'. The patterns arising out of such short run behaviours permeate broader system scales but at a much slower rate; the rate of vertical interaction between subsystems progresses more weakly and slowly so intuitively, the greater the scale, the lower the frequency (Levin 1999, 17; Holling 2001, 393). In summary, smaller subsystems change more rapidly than the larger systems within which they are embedded. Establishing the relationship "between system size and rate of change introduces some conceptual order into discussions [regarding] the proper scale on which to address environmental policy goals" (Norton and Ulanowicz 1992, 244).

The human body provides a familiar example of a hierarchically organised system. As complex adaptive systems, our 'hierarchy' can be constructed from any given point along the agent-to-aggregate continuum – mitochondria, membrane, and nucleus into cells; cells into tissue; tissues into organs and muscles and so on (Simon 1962, 469). Likewise, presentation of a simple ecological hierarchical series might proceed as follows: cell, organism, population, community, ecosystem, and so on. Each level (subsystem) is composed of the subsystems on the level below and conditioned by the level above, although as O'Neill et al (1986, 61) point out, in the ecosystem context the simple series presented is unlikely to have utility "across the range of observation sets and spatiotemporal scales involved in … analysis." This is so because discerning the composition and functioning of an ecosystem across the range of scales from cell to the ecosystem would be an impossible task (O'Neill et al 1986, 61). Selecting scales and determining boundaries and membranes in *any* complex adaptive system: "…represents conceptualizations (models) of the system that are *managerially relevant* and *naturally appropriate*" for achieving specified goals (Norton and Ulanowicz 1992, 247, original emphasis).

The key to differentiating hierarchical levels in a *cas* is to recognise patterns and use them, keeping in mind that simplification is essential to explanations of *cas* behaviour. Differentiation involves establishing which peripheral details can be eliminated without losing the 'truth' of the system and then sorting agents into aggregates in order to simplify the task of recognising behaviours and patterns. We can identify patterns because we have the ability to recognise regularities, repetitiveness, and relationships. The levels of the hierarchy represent various action settings within the *cas*. By eliminating peripheral details, we can present the hierarchical structure as a system of basic constituent parts which can be arranged in a multitude of combinations according to what aspect of it we are studying.

The Seven Basics of Complex Adaptive Systems

Holland (1995, 10 - 37) introduced seven organising principles or elements (basics) of *cas* into systems discourse. These elements enhance our understanding of how complex adaptive systems function. They are classified as either *properties* or *mechanisms* which enable researchers to treat all complex adaptive systems as families of related agents and to synthesise characteristics, principles and features into a simple model (Levin 1999, 13). Once familiar with the four characteristics and seven basics, we can use them to discern *cas* in all aspects of our lives. Immune systems, viruses, rainforests, seabed geomorphic features, neural networks, coral reef ecosystems, biospheres, economies, political systems, epistemic communities, corporations, cultures, tribes, organisations, institutions, and the planet we live on are all systems that bear the seven genetic markers of complexity – (i) *aggregation*; (ii) *tags and tagging* (iii) *non-linearity*; (iv) *flows*

(v) *diversity*; (vi) *internal models,* and (vii) *building blocks* (Levin 1999, 12; Waldrop 1992, 145).

Aggregation

Aggregation is a basic property of *cas*, and can be considered in two senses. The first is that of simple categorisation – we group similar things together because we assume that they are roughly equivalent. We make generalisations out of necessity and with the greatest of ease – fish, trees, planes, rocks, economies and children are examples of first sense aggregation that we use even though we are aware that there are many sub-categories of each. Not all distinguishing details are relevant to our needs; the simple process of aggregating helps us decide which details to ignore and which to include so that differences between categories can be clarified (Levin 1999, 13). From the details we select we can then search for patterns and building blocks with which to construct a model of the particular *cas* we are investigating (Holland 1995, 10-11).

The second sense of aggregation arises out of the first, but deals with what *cas* do rather than how they are modelled. Second sense aggregation explores how the aggregate interactions of less complex agents contribute to the emergence of complex, larger scale behaviours (first sense aggregation) (Holland 1995, 11). Aggregates formed in this way can in turn act as agents at a higher level – *meta agents* – and meta agents can be aggregated into *meta-meta agents* and so on. The hierarchical organisation so typical of *cas* is realised when this process is repeated several times over (Holland 1995, 11-12).

While the first and second senses are subsets of the property of aggregation, it is the second sense that builds on one of the key characteristics of *cas* – emergence – and it is the attendant mystery of this emergent behaviour that adds the ‘complex’ to adaptive systems. Studies of *cas* are contingent on the researcher’s capacity to locate the mechanisms, catalysts or leverage points that enable elementary agents to form highly adaptive aggregates (Holland 1995, 12).

Tags and Tagging

Tags and tagging facilitate the formation of aggregates because agents identify, and are attracted to, particular tags or symbols. Common examples of tags include banners, flags, trademarks and memberships. In the natural world, visual patterns of colour or movement displayed by species to lure mates are considered tags (Holland 1995, 12-13). In human social systems, rules involve the specification of tangible tags such as licenses or permits, and tags are used extensively to mark locations in terrestrial common pool resources to warn those who break the rules (Ostrom 1999, 522). These examples demonstrate how tags and tagging work- they are functional mechanisms because they facilitate *selective* interaction. Tags enable agents to aggregate, and aggregation plays a central role in the agent/meta-agent/meta-meta agent hierarchical, multiscalar nature of complex adaptive systems (Holland 1995, 14-15).

Interaction between agents within the aggregate involves filtering of information, as well as specialisation and cooperation between agents and between aggregates in the network and in the system, so in addition to their crucial role in agent aggregation, tags are also intrinsic to network definition and evolution. They help agents identify other agents that have transactional utility, that is, those that might prove useful as destination points for flows of information or materials (Holland 1995, 14-15). The upshot is that useful tags flourish while those with minimal or no utility weaken and eventually disappear. Such discriminatory behaviour is the result of experience, adaptation and necessity emerging over time, and applies as much to the biological agent as it does to the human social agent and to the latter's ideas and ideologies.

Non-linearity

Non-linearity is a basic of complex adaptive systems analysis because, as discussed above, *cas* analysis does not lend itself to linear thinking. Non-linearity is anathema of reductionism. If linearity means that we can arrive at the value of a whole by totalling the values of its individual parts (Holland 1995, 15), then non-linearity implies the converse – the whole is much more than the simple sum of its parts (Ostrom 2004, 14). *Cas* properties are explained by an understanding of the *relationships* among parts rather than by an understanding of each of these parts in isolation (Manson 2001). Non-linearity is a challenge to those who approach the study of systems from a reductionist perspective, who search for stable cause-and-effect relationships, theoretical and empirical neatness, and something quantitative to quantify.

Complex adaptive systems abound in non-linearities. There are rarely, if ever, simple cause-and-effect relationships in *cas*, indeed causal relationships in complex systems are disproportionate in that small changes in critical variables can lead to disproportionate, perhaps irreversible, changes in system properties referred to as "accidents of history" (Levin 1999, 14).

The pervasive non-linear properties of *cas* means there are also significant degrees of uncertainty and unpredictability. The net effect is unstable system parameters. In contrast, linear systems "evolve smoothly and continuously toward a single equilibrium state". After a disturbance "the equilibrium of linear systems is restored through negative feedback mechanisms" (Briassoulis 2004, 5). The property of non-linearity in *cas* allows for the absorption and buffering of quite radical shifts in system tempo and organisation/re-organisation. This concept is known in ecological systems as *resilience* and in human social systems as *robustness* (Anderies, Janssen and Ostrom 2004, 1).

Notwithstanding the dynamics caused by the non-linear nature of *cas,* discernable order and behavioural patterns do exist, sometimes to the extent that a system can be understood and 'fuzzy' predictions made (Wilson 2002, 335). For example, the nutrient-rich upwellings scattered about the world's oceans are caused by patterns of currents that attract, or bring with them, aggregates of marine invertebrates and phytoplankton. These in turn attract other aggregates of fish, marine mammals, seabirds, and human fishers. We can identify particular physical, biological and social distribution patterns and discern a particular order (coherence) at these patches of hyper-activity: an aerial view of an upwelling would reveal various sized patches of agent aggregates exhibiting patterns of behaviour.

Agents (human and non-human) at ocean upwellings behave according to a multiplicity of intrinsic and extrinsic rules at multiple scales driven by the need for survival (Levin 1999, 45). If we were to return to an upwelling over a period of time we would be able to discern and identify idiosyncratic and self-reinforcing patterns of behaviour and a certain order even though we would be hard pressed to explain these component interactions and behaviours in linear terms.

Flows

Flows – the movement of goods, capital, energy, materials, ideas or information from one location to another – are considered a property of complex adaptive systems rather than a mechanism (Holland 1995, 23). In contrast to the challenges involved in describing non-linearity, flows are relatively easy to illustrate because they can be measured by observation alone and often in relatively short time frames. Anthropologists, for example, can measure the flow of information and associated normative changes within a particular social system in much the same way that economists can calculate flows of goods and services through an economy (Levin 1999, 77).

Discussion concerning flows introduces the notion of *networks* into the concept of hierarchical organisation of complex systems. In network literature, the points where flows intersect are referred to as *nodes*. In *cas*, nodes can be agents, institutions, organisations and hierarchical levels. They are the key leverage points for action and interaction within the system. The paths that enable agent interaction are known as *connectors*, and a constellation of nodes and connectors is classified as a *network*. Mapping the nodes and flows through the network provides insights into the dynamics of the system (Holland 1995, 23; Eoyang, Yellowthunder, and Ward 1998, 9; Levin 1999, 77). A marine ecologist, for instance, can describe the flows of nutrients through a trophic web; even though the trails we choose to follow will be arbitrary, we can map the impacts and consequences of flows by tracing the movement of material and information through the constellation of nodes and connectors that make up the network.

All networks are composed of interconnected points in a constellation of influence because: "…the state of the parts that are connected … affect each other through the network" (Bar Yam 2003, "Network"). The term *network* can be applied to the connections that enable interactions and influences between system parts, or to the system as a whole. The complexity of network behaviour determines how we approach investigation and analysis of the network: the investigator can choose to focus on behaviour of the parts as a result of their connections through the network, or alternatively, examine how the system as a whole behaves because of the parts and the network (Bar-Yam 2003, "Networks"). This thesis follows to a greater extent the former approach.

Flows have two properties: (i) the *multiplier effect*; and (ii) the *recycling effect*. The multiplier effect involves flows emanating from a particular node. Holland depicts the *multiplier effect* in a simple example drawn from basic economics: when a home is constructed, the owner pays a building contractor, who employs tradespeople, who purchase commodities and food and so forth. The impact of home construction multiplies across the economic network (Holland 1995, 25).

The second property, the *recycling effect*, explores the effect of cycles in a network, the interactions between multiple nodes, and the ability of a system to capture and recycle critical resources under sometimes challenging conditions and loss of resources (Holland 1995, 25-27).

Flow targets are identified by their tags, or via the process of tagging. Agents are constantly adapting their internal models and external behaviours relative to flows of information received from other agents. It must also be emphasised that information, materials, energy and experience flow beyond the system – *cas* are not fixed or immutable structures. A large volume of tangible and intangible 'matter' is both exported and imported across system boundaries and yet flux is sensed rather than seen (Golley 1995, 205).

Feedback and feedback loops are integral to effective flows. Feedback is the "influence on a system component mediated by changes induced by that component", and a feedback loop is the "chain of influence of any length, in which a system component is influenced indirectly by changes it has induced" (Levin 1999, 233). Agents use positive and negative feedback from the environment as well as from other agents to assess their impact on the system, as input into their internal models, and to strengthen their reserve of strategies for future problems (Seel 1999, 2)

Diversity

Variety is the spice of life and it is the system's capacity to diversify and adapt that ensures its future. As a property of *cas*, *diversity* is the upshot of progressive adaptations and is integral to the evolutionary process (Holland 1995, 29). In ecological systems diversity is hierarchically ordered into a: "…diversity of populations within a species, a diversity of species within a functional group, and a diversity of functional groups within an ecosystem" (Levin 1999, 77). Similarly, in human social systems we find a diversity of ideas within a community, a diversity of communities within a state, and a diversity of states within a region.

Diversity in complex adaptive systems is neither random nor accidental. Whether fish, fowl or government, the persistence of any agent according to Holland: "...depends on the context provided by other agents. Roughly, each kind of agent fills a niche that is defined by the interactions centring on that agent" (1995, 27). While the removal of one agent creates a temporary vacuum, it is eventually filled by another courtesy of a flurry of interactions and adaptations. The 'new' agent fills the niche left by its predecessor and continues most of its predecessor's interactions.

Diversity is also realised when agents disperse and open up fresh opportunities for new interactions thereby creating new niches which can be exploited through modifications of other agents (Holland 1995, 28). Holland provides the ecological example of mimicry, which sees insects mimicking twigs or fish mimicking stones to protect themselves or to trick prey (1995, 28). Whether ecosystem or economy, diversity emerges from competition *between* agents rather than for the benefit of the system as a whole. Adam Smith, for instance, argued that economic systems are developed with the help of an 'invisible hand' which guides the actions of competitive and selfish individuals whom ultimately, (if unintentionally), serve society's best interests (Levin 199, 178).

Diversity serves a distinct purpose in system evolution and progression - as each adaptation takes place it generates potential for new interactions and creation of new niches. All this motion contributes to a peripheral characteristic of *cas* described as *perpetual novelty* (Holland 1995, 27). The perpetually novel status of complex adaptive systems is why they are non-linear systems.

Internal Models

Every agent in a complex adaptive system possesses an internal model, either *tacit* or *overt*, that enables the agent to anticipate, predict and adapt its behaviour as necessary. The basic process for constructing models has already been illustrated in the overview of *aggregation*, which described the elimination of finer details in order to emphasise selected patterns. The agent searches for patterns (repetitions) in the deluge of information it receives and converts these patterns into changes (situational responses) in its internal structure. These changes in internal structure must allow the agent to anticipate the consequences that follow when that pattern (situation) is again encountered (Holland 1995, 31-32). In other words, the agent is influenced by the patterns it perceives and adapts its internal model in anticipation of possible future scenarios. This in turn leads to the *cas* itself anticipating what will occur in the future, sometimes to the point of self-fulfilling prophecy. While successful anticipation of future scenarios is far from fait accompli, this concept is not as far-fetched as it seems. In human social *cas*, for instance, predictions of a looming recession can set alarm bells ringing among consumers and dampen their enthusiasm for spending. This has a flow-on effect that results in the majority of agents in the economic system influencing the response of the whole system. Anticipation of a difficult financial future can lead to a self-fulfilling prophecy whereby the economic system of a state does goes into recession because of the behavioural patterns the prediction inspired (Waldrop 1992, 146).

As already discussed, *cas* agents process the contents of flows – information, material, knowledge or experience – to assess their impact on the system itself; as input for development of internal models; and to construct strategies for future problems. Armed with the capacity to strategise, even the most basic of agents can anticipate the future through *tacit* internal models that "prescribe a current action, under an *implicit* prediction of some desired future state" (Holland 1995, 33). A simple bacterium, for example, follows a basic strategy for action – by moving in the direction of a chemical gradient it can predict where food is located (Holland 1995, 32). In a marine ecosystem, fish in a shoal swims toward the nutrient-rich upwelling (sub-system determined by oceanographic patterns) to feed. Fish can do this because they identify patterns (repetitions) among the torrent of environmental information that signals food sources at the upwelling and they do so because of their *tacit* internal models.

An *overt* internal model, on the other hand, provides the foundation for explicit explorations of alternatives. The classic example of an overt internal model is the agent visualising potential move sequences before moving a piece in a board game such as checkers or chess, a process known as strategising (Holland 1995, 33). Both tacit and overt internal models are found in every kind of *cas* (Holland 1995, 33). One way of distinguishing between overt and tacit internal models is that the former are built on variants of time and thought, whereas the latter are more subtle and make less demand on the internal resources of an agent.

Internal models are activated in particular situations and give rise to certain systemic behaviours – the efficacy of the system's response allows agents to distinguish effective from ineffective internal models (Waldrop 1992, 146). Agents process the contents of flows of information, material, knowledge or experience, to assess their impact on the system, as input for the development of internal models, and to construct strategies for future problems. Armed with the capacity to strategise, even the most basic of agents can anticipate the future through tacit internal models that "prescribe a current action under an implicit prediction of some desired future state" (Holland 1995, 33). For instance, every creature on the planet with a brain, no matter how basic, has multiple implicit predictions which are genetically programmed to take action X, Y and/or Z in situation A, B or C. Even a bacterium is genetically encoded to gravitate toward those environmental conditions which favour survival (Waldrop 1992, 146). The structure from which we infer the agent's environment is also a key determinant of the agent's behaviour:

> … if the resulting actions anticipate useful future consequences, the agent has an effective internal model; otherwise it has an ineffective one. With an appropriate way of connecting future credit to current actions, evolution can favour effective internal models and eliminate ineffective ones (Holland 1995, 33-34).

Building Blocks

As has already been established, one can always discern patterns in *cas*. These patterns provide the *building blocks* with which to construct internal models. Building blocks give agents a repertoire of plausible actions which can be used for various situations, although it must be stressed that a repertoire is defined by necessary details, not perfect knowledge of *all* possible rules applying to the situation at hand. The use of building blocks to produce internal models is a pervasive feature of *cas*, and building blocks themselves are mechanisms that "serve to impose regularity on a complex world" (Holland 1995, 37). A complex scene can be resolved by locating those elements "that have already been tested for reusability" through natural selection, learning, and processes of elimination (trial and error). By repeatedly using 'recyclable' building blocks, we gain valuable experience about a particular situation, even though the blocks may never again be assembled in exactly the same combination (Holland 1995, 34).

The physical sciences are built from the premise that all matter is formed out of the same building blocks. The multiple variants that constitute proteins, for example, are arrangements of just twenty different amino acids (Simon 1962, 478). The universality of elements "complements the universality of mechanical laws (classical or quantum) that govern their motion" (Bar-Yam 1997, 1). From bacteria to giraffes, photosynthetic to chemosynthetic, from the freezing icescapes of the polar regions to the boiling waters of hydrothermal vents, and from the simple to the complex, life in all its richness and diversity not only exists, but in many extremes it thrives. Variety is a basic ingredient for life and yet life's building blocks are remarkably simple and shared by every life form on the planet because they have evolved from a primordial cocktail of chemicals and functions. Similar polymers, proteins consisting of the same basic elements, the genetic code, and the same metabolic steps for both bacterium and human – all life forms built on (evolved) from these essential building blocks. As Jacob observes, "[w]hat characterises the living world is both its diversity and its unity" (Jacob 1977, 1164). Since the appearance of the first primitive, self-reproducing organism that represented 'life', evolution has proceeded largely by altering already existing compounds – building blocks. While new functions developed as new proteins appeared, these were variations of an existing theme (Jacob 1977, 1164).

As well as being the basis for composition, building blocks enable agents to decompose complex processes and systems into smaller parts which can then be combined and recombined repeatedly and at diverse levels (Ostrom 1999, 523). The process of decomposition helps the agent identify the particular set of rules required to rectify a situation. The driver experiencing a flat tyre while driving, for example, decomposes the response situation into 'car' + 'road + 'tyre' + 'jack'. By using her set of everyday building blocks she can construct an appropriate course of action that will lead to desirable outcomes even though the driver may never have been in this exact situation before (Holland 1995, 37).

The agent learns what set of rules is required to rectify a situation through trial, error and experience. Depending on the complexity of the problem, solving it can mean following a single path or working through a maze. Simon saw problem solving as a process of natural selection and drew parallels between biological evolution and human problem solving (1962, 472-73). He noted that trial and error was not random but a highly selective process – agents examine the "new expressions" arising from the transformation of existing ones, and decompose them to see whether they represent progress toward the goal (1962, 472). Signs of success encourage a further search in the same direction. Should progress slow or stop, the direction is abandoned and a new one followed, indicating that problem solving involves "selective trial and error" (p472). Selectivity, as Simon notes:

> ...derives from rules of thumb ... that suggest which paths should be tried and which leads are promising – we do not need to postulate processes more sophisticated than those involved in organic evolution to explain how enormous problem mazes are cut down to a reasonable size (472-73).

Simon identified *feedback, trial and error* and *experience* as the basic elements of selectivity. The processes of trial and error applied in human problem solving and organic evolution follow the same path – while various elements come into play, it is the stable elements that are selected to provide new building blocks.

Building blocks are abstractions which agents assemble and reassemble according to the situation or problem at hand. Complex adaptive systems are constantly revising, rearranging, adapting, and adjusting their building blocks as experience accumulates. Nevertheless, even with the 'right' level of detail and the relevant building blocks, perpetual novelty remains a pervasive feature of *cas* (Holland 1998, 45).

Conclusion

This Chapter has established that a complex adaptive system is a hierarchical, self-organised emergent and adaptive entity that functions according to its own set of rules and strategies. The dynamic nature of complex adaptive systems means that the behaviour of the whole cannot be understood by the sum of its parts. The dynamics of a *cas* – its topology, environmental influences, the characteristics of the agents within the system, and the system itself – demand constant behavioural adaptations in action settings.

Complex adaptive systems are neither static nor balanced – instead, they are in a state of perpetual novelty. The complex adaptive systems paradigm provides the best description of the global oceans governance system and an ideal methodology with which to understand the dynamic processes that take place within this system on a scale determinative of "priority social goals" (Norton and Ulanowicz 1992, 244).

This chapter has also introduced the concept of a *high seas epistemic community,* an entity which will be described and analysed in more detail in the following three chapters. The high seas epistemic community is recognised as the ideological impetus behind high seas MPA discourse within the global oceans governance *cas* and the community's goal of *a global representative system of MPAs by 2012* is embedded in its broader priority social goal of ensuring oceans biodiversity is protected. The seven basics of *cas* – (i) aggregation; (ii) tags and tagging; (iii) non-linearity; (iv) flows; (v) diversity; (vi) internal models; and (vii) building blocks – provide a cache of metaphors for describing and analysing the high seas epistemic community's goal and the fitness of the community in a governance system that is in a constant state of flux. The emergence of these basic features within the global oceans governance *cas* setting will be traced through Chapters Four and Five and deconstructed in Chapter Six.

All complex adaptive systems are emergent systems where patterns of behaviour, identifiable properties, basic rules and coherent structures emerge from the interactions between agents at various hierarchical levels within the *cas*, and where the *cas* itself exhibits patterns of 'whole' behaviour that can be discerned over long periods. It is worth reiterating that while control is highly dispersed in *cas*, complex adaptive systems do have leverage points whereby small amounts of input have the capacity to produce significant changes. Agents that have achieved a level of 'fitness' keep the *cas* functional by creating and taking advantage of conditions that are both necessary and sufficient for the system's survival. Chapter Seven identifies and explores a leverage point for protection of deep oceans biological diversity in the form of a prototype high seas MPA. It will be argued that while a prototype high seas MPA is a comparatively small input, it has potential to produce significant changes in high seas biodiversity management, or at minimum, steer the approach toward marine protected areas in oceans beyond national jurisdiction in a more practical direction.

The global oceans governance 'system' bears the features and characteristics of *cas* – hierarchical organisation; adaptation; self-organisation; and emergent behaviour. It is also polycentric and multiscalar, and operates to a basic set of rules and components that interact simultaneously, with multiple options for interaction being presented by the system itself.

The high seas epistemic community is also a hierarchical and self organised Level 1 subsystem nested within the larger global oceans governance *cas*, although as proposed in Chapter Six, its capacity for adaptation and emergent behaviours seems to be diminishing somewhat, bound as it is to the linear and temporally finite tag of *a global representative system of MPAs by 2012.*

The next two chapters provide summaries of international fora that have addressed the concept of high seas marine protected areas, either as the main agenda item or as part of a broader oceans governance schedule, with the *cas* paradigm providing the metaphorical signposts. A key objective of Chapters Four and Five is to demonstrate the emergence of patterns of behaviour around high seas MPA discourse, the emergent influence of the high seas epistemic community and the evolution, ascendancy, and primacy of the community's 'macro-goal' that has been embraced by some, although certainly not all, agents in the global oceans governance *cas.* The high seas epistemic community' primary tag – *a global representative system of MPAs by 2012* – is underpinned by plans of action, 'roadmaps', and strategies considered by high seas MPA proponents to be integral to protection of oceans biodiversity beyond national jurisdictions and the effective functioning of the environmental mandate of the global oceans governance system.

The physiology of the global oceans governance *cas* is best understood by exploring the connectivity – the relationships – between its parts rather than analysing each part in isolation (Gallagher and Appenzeller 1999, 79). Over time these patterns of interactions manifest in emergent phenomena that are observable at the macro-level (for example, the United Nations General Assembly or the Conference of Parties to the Convention on

Biological Diversity) even though they are generated by agents at the micro-level (the high seas epistemic community) (Seel 1992, 2; Parvard and Dugdale 2005).

CHAPTER FOUR

EMERGENCE OF THE MACRO-GOAL ERA AND THE HIGH SEAS EPISTEMIC COMMUNITY 1972 - 2002

Introduction

The complex adaptive systems paradigm chapter provided a suite of metaphors for systems analysis and a paradigmatic framework within which to examine the concept of high seas marine protected areas, the key proponent of this concept (the high seas epistemic community), and the global oceans *cas* of which it is a part. The value of the *cas* paradigm and its suite of metaphors will be expanded in Chapter Six, where the internal models, building blocks and tags of the high seas epistemic community and its priority social goal will be analysed in greater detail.

The primary aim of this chapter is to provide some historical context to, and evidence of, the rise of the macro-goals and concepts driven by eco-ethical ideologies in international environmental policy development, the growing influence of international environmental NGOs in this arena, and the emergence of the high seas epistemic community and its primary tag of *a global representative system of MPAs by 2012.* The community participates in most large scale governance and research forums including gatherings of kindred spirits at IUCN World Congresses; marine scientific research conferences; the Convention on Biological Diversity's Conference of Parties; meetings organised by OECD[50] countries, and groups formed under the mandate of, and reporting to, the United Nations General Assembly (UNGA). The reach of the high seas epistemic community into the Conference of Parties to the CBD and the UNGA is detailed in Chapter Five.

This chapter looks more closely at the emergence of behavioural patterns among participants at large scale environmental NGO gatherings, and how repetitive language

[50] Organisation for Economic Cooperation and Development

and terminology has evolved into building blocks for protection of oceans biodiversity in areas beyond national jurisdiction. In *cas* terms, this chapter presents an overview of the short run horizontal interactions that can be used to identify subsystem behavioural patterns (the high seas epistemic community). The next chapter discusses the flows of information that filter up through the longer run vertical interactions to 'higher' hierarchical levels of the system such as the UNGA and Conferences of Parties to the CBD, and the impact that this has had on high seas MPA discourse at these levels.

The section discussing relevant elements of the LOSC and negotiations between competing interests is a crucial inclusion. It provides some international oceans law background and context, a map of the geopolitical boundaries established in the Convention and also reminds us of the primacy of the LOSC in oceans governance and the inherent difficulties in negotiating broad scale instruments among a multitude of competing interests. At gatherings of such immense scale a significant degree of compromise is required to reach consensus on key issues where views diverge significantly. These divergences and inherent difficulties are also reflected in the summaries of the more 'formal' global oceans governance fora outlined in Chapter Five.

Not all gatherings involving the high seas epistemic community are detailed: as Chapter Three emphasises, demarcating hierarchical levels in complex adaptive systems can be achieved by recognising emergent patterns of behaviour. Patterns can be identified because we have the ability to distinguish regularities, repetitiveness, and relationships.

Differentiating between hierarchical levels in the global oceans governance *cas* involves establishing which peripheral details can be eliminated without losing the 'truth' of the system and then sorting agents into aggregates in order to simplify the task of recognising behaviours and patterns. To cover all international forums relevant to the subject of this thesis would be an exhausting process; instead I have selected those that highlight regularities, repetitiveness and relationships to demonstrate emergent and increasingly influential patterns of behaviour relating to the evolution of high seas MPA discourse and the fit of the high seas epistemic community and its priority social goal in the global oceans governance *cas*.

The Environmental Macro-Goal Era

The Emergence of the Macro-Goal in the Global Oceans Governance Complex Adaptive System

Table 6 identifies key events that have driven the evolution of oceans governance principles, language, development of goals, conservation and ecosystem management concepts, strategies, and multilateral agreements devised for controlling or at the very least influencing human interaction with the marine environment. Apart from the inaugural World Congress on National Parks, all the events listed in Table 6 epitomise a 'macro-goal' approach to oceans governance that is expressed in terms of objectives, principles, strategies or scope.

I use the term *macro-goal* is used to describe a priority social goal on a global scale. The 1972 United Nations Conference on the Human Environment (UNCHE) has been described as the "lynchpin and environmental conscience of the United Nations (UN) system" and the "hub from which spokes of policy networks extend to deal with a wide array of global environmental threats", including marine protection (Haas 2007, 1). The UNCHE marked the inception of international environmental grandiosity, and heralded an era of multilateral environmental agreements with a tendency for big pictures, grand ambitions and 'visions splendid'.

An inordinate amount of time has been spent at large-scale oceans conservation fora developing new, or recognising and reiterating existing global principles, motherhood statements, and lists of morally suasive 'musts', 'shoulds', 'should nots' and 'must nots' which, more often than not, subsume more practical, workable and, politically feasible plans for governments to pursue. The repeated use of particular terminology, which in the *cas* paradigm would be considered *tags* and *tagging*, creates an easily recognisable pattern in meetings convened to discuss environmental management and governance issues.

Table 6: Definitive events in oceans governance principles and development of macro-goals

Event	Year	Innovations
First World Congress on National Parks (Seattle)	1962	Discussion of creation of marine parks in international arena.
UN Conference on the Human Environment (Stockholm)	1972	Articulation of a litany of global principles and goals to guide social, economic, and environmental policy development.
United Nations Law of the Sea Conferences	1974 – 1982	Established, inter alia, areas of coastal state jurisdiction and the common heritage of mankind principle, high seas freedoms with some restrictions, and management of the mineral resources of the seabed (Area).
IUCN General Assembly (Costa Rica)	1988	A resolution that established a policy framework for marine conservation, including the creation of a global representative system of marine protected areas.
Rio Earth Summit (Rio de Janeiro)	1992	Convention on Biological Diversity; Agenda 21
World Summit on Sustainable Development (WSSD) (Rio + 10), (Johannesburg)	2002	Held to mark the ten year anniversary of the Rio Earth Summit and also assess progress made during the intervening decade

The high seas component of these discussions is no exception. Hard and soft international environmental instruments and international fora provide fertile ground for development of sound basic principles and ideals, but they usually fall short of identifying the necessary and sufficient conditions for putting principles into actions. Technological developments in travel and communications have enabled actors to come together either physically or virtually, and the growing number of participants and observers at meetings such as the UNGA or conferences of parties to global or regional environmental instruments is reflected in the increasingly broad scope and ambition of the recommendations and goals that emerge from them.

Arising out of these global fora is an ever-burgeoning body of literature addressing the protection and management of biodiversity in oceans beyond national jurisdictions – the priority social goal of many of the participants, and in particular, the high seas epistemic community. Those involved in global oceans governance meet and discuss the tools, methodologies, laws, rules and concepts for governing the actions of humans to sustain oceans biodiversity.

Actions already identified as potential protective mechanisms and measures for protecting deep oceans biodiversity include a moratorium on bottom trawling in the high seas; improving the implementation of the UN Fish Stocks Agreement (FSA)[51] and the Food and Agriculture Organisation (FAO) Code of Conduct to enhance their effectiveness; expansion of the FSA to include discrete high seas fish stocks; improving the accountability of members of regional fisheries management organisations (RFMOs); the implementation of short term emergency measures to protect vulnerable geomorphic features; new international environmental agreements, implementation agreements for existing instruments; and improved implementation and expansion of the existing legal regime to take into account high seas biodiversity through MPAs and other protection measures.

Macro-Goal Champions

As noted in Chapter Three, the increasing focus on high seas governance over the last few decades has seen the emergence of a high seas epistemic community. Embedded within the community's overarching priority social goal of protecting oceans biodiversity is another relating specifically to MPAs within and beyond national jurisdiction, that of a *global representative system of marine protected areas by 2012*. It is this goal that frames discussions about high seas marine protected areas, and it is this goal, together with its various permutations and the high seas epistemic community's preferred approach to the issue of MPAs in areas beyond national jurisdiction, which has provided the motivation for this research project.

[51] The full title of the UN Fish Stocks Agreement (UNFSA) is the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on Law of the Sea of December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.

The involvement of NGOs in international oceans affairs had a modest beginning at the 1972 UN Conference on the Human Environment, “the first of many UN mega-conferences organised for designated fields of particular complexity” (Johnston 2002, 11). A decade later, and by the close of the fifteen year negotiation period for the LOSC in 1982, over 100 NGOs had been accredited as observers at multilateral conferences, signifying the development of “external penetration of the diplomatic arena” (Johnston 2002, 11). Since then it has become increasingly common for government delegations with oceans management mandates to include a number of non-government participants, and at the global level, oceans-related fora are usually accompanied by parallel NGO meetings. Environmental NGOs have emerged as key influences on the outcomes of international oceans-related conferences and meetings, however, as Johnston (2002, 11) notes, irrespective of philosophical, strategic and tactical differences, one of the ties that binds them is their universal criticism of government efforts to deal with oceans management issues. Activist environmental organisations are eco-ethically driven whereas states tend to be more ‘neutral’ or take a position that will benefit or protect first and foremost domestic or diplomatic interests. The extraordinary size of the international eco-ethical community has given rise to alarm and resentment in many countries and: “...there is probably no bureaucracy or extractive or manufacturing industry that feels entirely secure in the face of this army of dissenters” (Johnston 2002, 12).

Key NGO players in the high seas epistemic community and global oceans governance *cas* are the World Conservation Union (IUCN) and its subsidiary, the World Commission on Protected Areas – Marine (WCPA – Marine), the Worldwide Fund for Nature (WWF), Greenpeace and the Deep Sea Conservation Coalition. WCPA – Marine views itself as “the world’s premier network of Marine Protected Area (MPA) expertise” with a mission “to promote the establishment of global, representative system of effectively managed and lasting network of MPAs” (Laffoley 2006, 3). It sits within the IUCN’s World Commission on Protected Areas and works in partnership with the IUCN Global Programme on Protected Areas and the IUCN Global Marine Programme.

WCPA - Marine identifies its roles, "through the unique reach, influence, accumulated knowledge and expertise of our members", as:

- Convening, coordinating and networking, in order to help governments and others to plan, develop and implement MPAs, MPA networks, and the global system, and integrate them with all other sea and coastal uses and maritime sectors;
- Ensuring better application of the best science, technical and policy advice on MPAs, MPA networks, and the global system;
- Generating, synthesising and disseminating knowledge on MPAs, often in the form of best practice advice, to a diverse range of players;
- Developing enhanced capacity at different levels to address the variety of challenges that funding and implementing effectively managed MPAs can present; and
- Fostering innovation to come up with exciting new solutions and ideas to tackle current and future challenges." (Laffoley 2006, 3).

Although the concept was firmly established by the advent of the new millennium, the *global representative system of marine protected areas by 2012* goal was endorsed in the eyes of MPA proponents at the 2002 World Summit on Sustainable Development (WSSD) and incorporated in section 32(c) of the WSSD Johannesburg Plan of Implementation. Written in accordance with Chapter 17 (Oceans and Coasts) of Agenda 21, section 32(c) calls for: "…the establishment of marine protected areas consistent with international law and based on scientific information, including representative networks by 2012" (Cicin-Sain et al 2004). Another common permutation of the primary tag is that of a *global representative system of marine protected area* ***networks*** *by 2012*.

The WSSD 2012 temporal target has been embraced by the high seas epistemic community, and a campaign devoted to: "...the completion [by 2012] of an effectively managed, ecologically representative network of Marine and Coastal Protected Areas within and beyond areas of national jurisdiction" has been established (WWF et al 2005). The IUCN, however, has been promoting the concept of a global representative system of MPAs since 1988 when it passed a resolution establishing a policy framework for marine conservation, including the creation of a global representative system of marine protected areas (IUCN 2003a).

The macro-goal of *a global representative system of MPAs by 2012* has since been recognised and endorsed by, *inter alia*, the UNGA, the UN Open-ended Informal Consultative Process (ICP), the Conference of Parties (COP) to the CBD, industrialised states including Australia and the United Kingdom (UK), and reiterated at numerous international conferences and workshops addressing ocean conservation issues since its endorsement in 2002 (Johnston 2004). Since the 2002 WSSD, the *global representative system of marine protected areas by 2012* goal has determined the direction of high seas MPA discussions at most multilateral oceans governance conferences, seminars, workshops and meetings. The global oceans governance network concept has inspired the development of a set of motherhood statements, overarching principles and practice guidelines that are championed by the high seas epistemic community and embraced by many agents in the global oceans governance *cas*, as reflected in some of the meeting statements contained in this and the following chapter.

Establishing areas of protection *within* the jurisdictional waters of coastal states is a relatively recent development in the chronicles of marine environmental policy development. Marine conservation is an “undisciplined discipline” which trails its terrestrial counterpart by a generation (Roff and Evans 2002, 636), although the two concepts – terrestrial conservation and marine conservation – are fundamentally different on a number of crucial planes. As demonstrated in Table 3, they need to be addressed in distinct if not disparate managerial frames of reference, even though lessons from terrestrial management experience can be drawn on to inform the design and management of marine protected areas, as discussed in Chapter Six regarding connectivity and corridors in protected area networks.

The success of marine protected area policy hinges largely on the capacity of stakeholders to arouse both public and political interest in the issue at hand. Within jurisdictional waters, issues such as 'NIMBYism'[52], lifestyle, occupation, ideology, economics, and resource and habitat degradation mobilise various stakeholders to oppose or support proposals for MPAs in their area. Even though coastal resources and habitats are experienced by few *in situ*, they nevertheless inspire a sense of stewardship among coast dwellers and those whose livelihoods depend on ocean resources. Much can, and is made of socio-psychological and socio-economic attachment to the marine environment, especially when the attachments and values upon which they are premised are framed as binary pairs of fixed opposites over policy proposals for marine protected areas. The argument is usually reduced to those 'for' or 'against' the concept of 'locking up' marine areas for conservation purposes.

Table 7: Differences between marine and terrestrial systems (Agardy 2000, 877)

Marine Systems	**Terrestrial Systems**
imprecise boundaries	relatively precise boundaries
large spatial scales	small spatial scales
fine temporal scales	coarse temporal scales
three-dimensional living space	relatively two-dimensional living space
relatively unstructured trophic webs	relatively structured trophic webs
non-linear systems dynamics	relatively linear systems dynamics
not well researched	relatively well researched

The ocean and sea floor beyond national jurisdiction does not fare so well in the socio-psychological attachment stakes. Beyond the first two or three kilometres of coastal sea and seabed, the majority of the public perceive a moody, dangerous, seething ocean harbouring creatures and features that threaten human survival in an environment beyond our wildest imaginings. Our perceptions of the marine environment are

[52] NIMBY is the acronym for "not in my back yard". It sums up the attitude of many citizens to environmental issues; they do not want the environmentally degrading activity in 'their backyard' (local area), or alternatively, agree that demarcated areas of protection are a great idea, but would like them created somewhere else. Hence NIMBYism, is a 'shortcut' term that encapsulates public and corporate opposition toward environmental protection measures such as marine protected areas.

underpinned by fear and ignorance; its blackness, 'nether-worldliness' and inaccessibility are both virtue and curse in the context of high seas marine protected area policy development. It remains for most of us, *oceanus caligens vel rigens,* "a hardened ocean shrouded in darkness" (Lopez 1986, 315), although technological developments are now bringing deep ocean habitats and life forms to our television, computer and movie screens and increasing public interest in the marine domain.

High Seas Marine Protected Areas as Part of a Global System of MPAs

The Idea Whose Time has Come

The concept of high seas MPAs is a more recent phenomenon, one which has emerged in part because of technological advances in scientific research and communications, and in part because the high seas has only been considered a separate geopolitical entity because of the Law of the Sea Convention. As already alluded to, we know less about the deepest oceans environs than we do of the moon. Nevertheless, human curiosity, economic need and technological innovation mean that with we know a little more than before, and that the motivation for looking increases exponentially as our knowledge bank expands and our resource demands grow.

It is difficult to define any moment in history which marks the introduction of marine protected areas in waters beyond coastal state jurisdiction as a concept for discussion at the international negotiating table. The IUCN has been a significant driver of the protected area concept since 1962 when it convened its First World Congress[53] on National Parks in Seattle. The inaugural Congress was devoted to exploring the notion of protecting terrestrial and marine vulnerable areas, habitats and species through spatial demarcation and management (Committee on the Evaluation, Design and Monitoring of Marine Reserves and Protected Areas in the United States et al 2000, 147). It was during the 1975 IUCN Marine Protected Areas Conference that the concept of MPAs 'arrived' as an issue warranting international collaborative action, and as 'an idea whose time had come' (Kingdon 2003, 1). Participants discussed potential selection criteria and management guidelines and called for the development of a globally representative

[53] The Congress is the governing body of the IUCN (IUCN 2004d, 1)

system of effectively and efficiently monitored MPAs (National Research Council 2000, 146), a concept which, as argued in Chapter 5, has since emerged as the high seas epistemic community's primary tag.

The global environmental theme was strengthening its grip on environmental politics and policy development. A three year collaborative and cooperative project undertaken by the IUCN, the World Wildlife Fund (WWF), the United Nations Environment Programme (UNEP), and 450 government organisations, NGOs and international bodies culminated in the production of the World Conservation Strategy in 1980. The three primary objectives of the Strategy were: (i) maintenance of essential ecological processes and life support systems; (ii) preservation of genetic diversity; and (iii) sustainable use of species and ecosystems. The Strategy was intended to provide an intellectual framework for guiding resource conservation policies with emphasis on coordinated efforts and solidarity of purpose at the global level (Government of Canada 2004).

The IUCN's calls for the development of a global representative system of MPAs as a primary organisational goal were confirmed at the 17th General Assembly in 1988 (Resolution 17.38), and articulated during the 19th General Assembly in 1994 in Resolution 19.46:

> To provide for the protection, restoration, wise use, understanding and enjoyment of the marine heritage of the world in perpetuity through the creation of *a global representative system of marine protected areas* and through the management, in accordance with the principles of the World Conservation Strategy, of human activities that use or effect the marine environment. (Kelleher, Kenchington and Bleakely 1994, 1, emphasis added).

Determined to build a nexus between policy and practice, the IUCN published *Guidelines for Establishing Marine Protected Areas* in 1992 (Kelleher and Kenchington 1992) following an agreement between the World Bank, the Great Barrier Reef Marine Park Authority (GBRMPA) and the IUCN Commission on National Parks and Protected Areas (CNPPA) to develop a document to guide the designation and implementation of a global representative system of MPAs. The four volume body of work divided the world's oceans into 18 regions demarcated primarily on biogeographic criteria but also informed by political boundaries.

It is interesting to note that the term *high seas* was referred to only twice in the Guidelines and then only in relation to sightings of cetaceans (Croom, Wolotira and Henwood 1995, 67; Batisse and de Grissac 1995, 86). Areas beyond national jurisdiction were identified once in relation to a proposal for a marine protected area to be located along the Hague Line (the maritime boundary between Canada and the US) to protect the rich biodiversity of the Gulf of Maine (in Mondor, Mercier, Croom and Wolotira 1995, 125). The mandates of the 18 working groups may have had some bearing on this oversight - each group was asked to identify national and regional priorities, however, there was no request for identification of *international* priorities in their assigned area. This approach may have inadvertently given rise to a frame of reference narrowed by geopolitics and lack of biological data and stakeholder knowledge: neither the participants nor the contractors would have possessed empirical knowledge of the ocean and seafloor beyond continental shelves or regional seas to make informed assessments.

High seas marine protected areas were also appearing on the radar of the United States' (US) administration. They were discussed during the 1991 'Wild Ocean Reserves' meeting hosted by the US National Oceanic and Atmospheric Administration (NOAA). The concept was refined, economic and management issues explored, and implementing mechanisms analysed including the utility and efficacy of international law for legitimising high seas marine protected areas (Hemphill 2005, 53-54), however, the issue was not progressed for further development. As the following section on the law of the sea conventions details, the US, and most other economically powerful nations, harboured significant concerns regarding the 'locking up' of sections of the high seas and seabed.

What Makes the High Seas the *High Seas*? The United Nations Law of the Sea Convention

It is beyond the scope of this thesis to present a complete history of the Convention or analyse its efficacy, relevancy, or its many regimes in detail. A significant body of work has and continues to be devoted to this task. Where necessary, however, important and relevant Parts and Articles of the Convention, together with the well documented contradictions, anomalies and challenges with potential to influence the creation of high seas MPAs will be highlighted because of the Convention's primacy in international marine law and oceans governance, its role as the jurisprudential centrepiece of high seas MPA discourse, and the patterns of behaviour that emerged regarding deep oceans governance.

The 1982 LOSC is considered the lead vessel in the flotilla of ocean management-related instruments and marine international law. The LOSC provides a significant number of normative and institutional building blocks with which to build regimes for global oceans governance. Arguably, it has achieved the status of "sacred text"[54] (Johnston 1997, 264-65 and 276-77). Extension of state sovereignty and the sovereign rights realised described in the LOSC has created a "magic" line where the burden of state responsibility and scope of state regulations and enforcement diminish considerably once crossed (Townsend-Gault and Smith 1993, 401).

The LOSC was the outcome of a convoluted and extraordinarily costly exercise in international compromise diplomacy that spanned a 15 year period (1967 – 1982) and covered a vast spectrum of ocean-related issues (Johnston 2003, 138). It entered into force in 1994 with the final document consisting of 320 articles and nine annexes crafted to govern the conduct of humankind in almost all uses of the world's oceans (Friedheim 1999, 659). The huge scale and diversity of interests represented at the third and final

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[54] The concept of 'sacred text' is derived from theology. Many of the world's organised religions have produced sacred scriptures that provide the authoritative basis for beliefs "concerning the role of the divine in human affairs and the principal value source for the cultures associated with them" (Johnston 1997, 265).

phase of negotiations from 1967 to 1982 (the third UN Convention on LOSC[55], referred to as UNCLOS III[56]) compelled participants to compromise on a multiplicity of outstanding and contentious issues – the latter being in plentiful supply – in order to reach resolution.

As depicted in Figure 1, areas subject to state sovereignty are divided into the following zones: internal waters, archipelagic waters, territorial sea, and the contiguous zone; however, a State's jurisdictional reach can extend across the exclusive economic zone (EEZ) and the continental shelf. Beyond these zones lay the *high seas* and *Area*. In the LOSC, *high seas* refers to the water column beyond national jurisdiction, while the international seabed is referred to as the *Area*, however, unless addressing these phenomena as distinct entities, the term *high seas* includes all marine areas beyond national jurisdiction.

The 1982 LOSC is supplemented by two implementing agreements – the 1994 Agreement relating to Implementation of Part XI of the Convention (known as the 1994 Part XI Agreement); and the 1995 UN Fish Stocks Agreement). These two implementation agreements relate directly to activities undertaken in the high seas and Area.

The seafloor and water column of the high seas are addressed as two distinct although not mutually exclusive entities in the Convention. Part XI of the LOSC and the 1994 Part XI Agreement established a regime for the ocean floor, seabed and subsoil thereof – referred to as the Area (Article 1) – and the non-living resources contained therein beyond the limits of national jurisdiction. The emphasis on mineral resources in Part XI reflects the knowledge and priorities of the time of the third round of negotiations – only the mineral resources of the Area were considered to be of economic interest and

[55] Refer to Chapter One, footnote 5 for distinction between the Conventions convened for negotiations (UNCLOS) and the final instrument (LOSC).

[56] There had been two previous attempts to reform and codify relevant international oceans law: UNCLOS I (1958) and UNCLOS II (1960), however, attempts at extending and modifying the existing customary law were insufficient and resulted in pressure on the UN General Assembly and Seabed Committee for complete reform (Vogler 1995, 48).

requiring a separate regulatory regime (Elferink 2007, 152-53).[57] While the value of genetic resources of the deep was becoming apparent during negotiations for the 1994 Part XI Agreement, the focus remained on mineral resources to lure reluctant States to the negotiating table and to resolve outstanding issues.

The inclusion of living resources in negotiations for the Part XI Implementing Agreement would have added more controversy, therefore their exclusion from the negotiating terms of reference was strategic (Elferink 2007, 153). The 1994 Part XI Implementing Agreement was crafted for the sake of US appeasement, however, despite significant changes it failed to encourage the US to ratify the 1982 Law of the Sea Convention.

What has proved particularly vexing for some in the context of contemporary oceans governance and associated challenges is that the terms referring to features within the Area – the 'ocean floor', 'seabed', and 'subsoil' – remain undefined in the Convention. Lack of meaning of the term *seabed*, for instance, may prove a legal obstacle for proposals to develop high seas marine protected areas in sites of geomorphic importance such as hydrothermal vent systems that are located in the Area. As Elferink (2007, 148) asks:

> Does the seabed only refer to solid materials that make up the bottom of the sea, or does it also include solids, water or other liquids or gases in contact with those materials? For instance, is the water flowing from a hydrothermal vent, and the materials it contains, part of the Area or the superjacent waters?

Elferink goes on to note that two criteria appear to be relevant to establishing whether particular features are part of the superjacent waters or seabed, one being their location in relation to the seabed, and the other that they can be clearly distinguished from surrounding waters. Again, he provides the example of a hydrothermal vent, noting that:

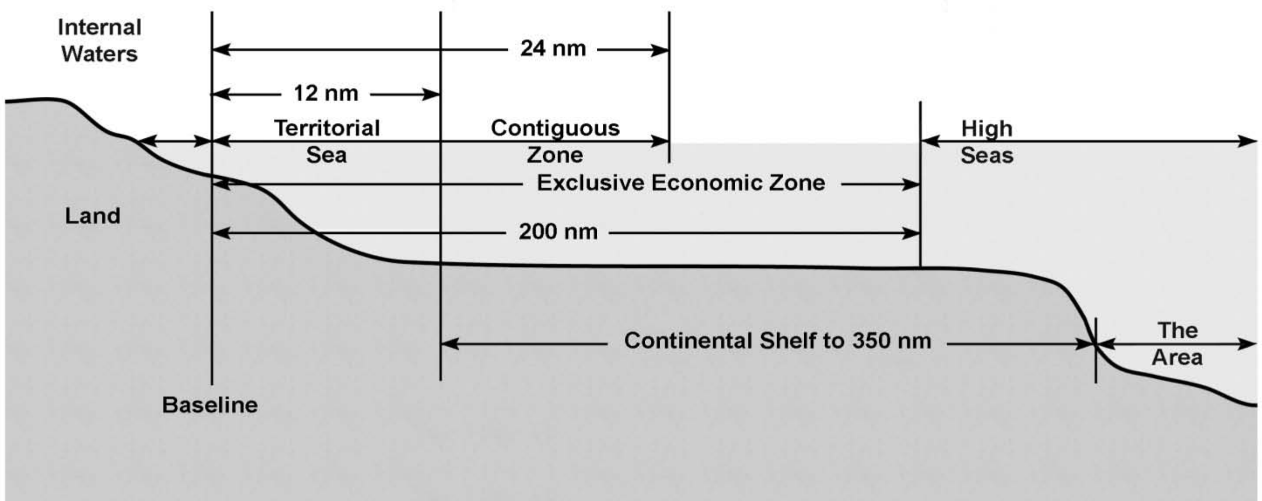
[57] The current interest in genetic resources of the Area, especially those derived from 'extreme' environments such as hydrothermal vents and cold seeps, has sparked a flurry of analysis and debate over the appropriate regulatory regime for these remarkable organisms. Similar debate underpins legal and institutional issues relating to appropriation of energy sources from the Area (Elferink 2007, 155). These issues are not addressed in any detail in this thesis due to the depth and volume of analysis that would be required, however, they are referred to throughout in the context of establishing high seas marine protected areas.

> ... water flowing from a hydrothermal vent that is an integral part of that hydrothermal vent system and that can be clearly distinguished from the hydrothermal vent system and that can be clearly distinguished from the surrounding waters because of its chemical and physical characteristics would seem to be located in the Area and as such would not form part of the waters superjacent to the Area (2007, 148).

Part XI articulates a number of principles governing the Area and establishes a detailed regime – the International Seabed Authority (ISA) – for the purpose of regulating the appropriation of mineral resources. The water column is addressed in Part VII, however, while it refers to the 'high seas', the scope of application of Part VII is "defined negatively" in Article 86 of the Convention (Elferink 2007, 144) which states that the: "... provisions of this Part apply to all parts of the sea that are not included in the exclusive economic zone, in the territorial sea or in the internal waters of a State, or in the archipelagic waters of an archipelagic State.

The regime for the high seas, together with a list of high seas freedoms, is set out in Article 87 of the LOSC. While States are free to use the high seas, albeit with due regard for the interests of other States, this does not amount to complete freedom as restrictions and conditions are also set out in the LOSC. Parties have general obligations to protect and preserve the marine environment (Part XII), to conserve and manage high seas living resources (Part VII, Section 2), and are subject to other rules of international law which may impose restrictions and/or conditions on high seas activities (Kimball 2005, 5). States are also required to take all necessary precautions and measures to protect and preserve rare or fragile ecosystems and habitats of depleted, threatened or endangered forms of marine life (Article 194 (5)) (Kimball 2005, 7). High seas freedoms include marine scientific research (subject to the provisions set out in Part XIII of the Convention), fishing (subject to the obligation to conserve and manage high seas living resources as articulated in Part VII, Section 2), navigation, laying of undersea cables and pipelines, and construction of artificial islands and other installations (Kimball 2005, 5). Activities forbidden by the Convention in, or on, the high seas are piracy, transportation of illicit drugs and slaves, and unauthorised broadcasting (Wang 1992, 77).

Figure 5: Maritime Zones under the Law of the Sea Convention



Source M. Haward and J. Vince (2008) *Oceans Governance in the Twenty-first Century: Managing the Blue Planet* (Edward Elgar Publishing Ltd, Cheltenham UK and Northampton MA USA), 34

The regime for the Area (established in Part XI and the 1994 Part XI Agreement, and which are together considered a single instrument (Kimball 2005, 8-9)) establishes a number of principles regarding exploration and exploitation activities such as environmental impact assessments and marine scientific research. One of the most profound principles set out in this regime is that the Area and its resources are the 'common heritage of mankind' and as such, no State may claim or exercise sovereignty or sovereign rights over any part of the Area or its resources, nor can any part of the Area or its resources be appropriated by a State or citizen of any State. Further, the benefits of activities in the Area extend to all humankind, irrespective of whether they are derived from resource appropriation, marine scientific research or objects of an archaeological or historical nature. It is also expected that activities in the Area will not harm the marine environment and that Parties will accept liability for any damage their activities may inflict (Kimball 2005, 9).

The ISA is the institution through which Parties to the Convention arrange and control their activities in or on the Area and it continues to develop rules and regulations for mining activities together with appropriate protection measures. The rules and regulations crafted for the appropriation of polymetallic nodules, for example, require that in any application for exploitation rights, the contractor must also define areas to be set aside exclusively as "preservation reference zones" where no mining will occur. Such zones are intended to provide areas of representative and stable biota so that comparative analyses of changes in the flora and fauna of the marine environment as a result of mining can be undertaken (Kimball 2005, 9-10).

Arguably, the two most contentious issues during the LOSC negotiations were those of access to the seabed and appropriation of marine minerals, and creation of a central international administrative authority to manage seabed exploitation activities. The US administration refused to endorse "the fruit of a decade of diplomatic handiwork" because of the linkages between the controversial seabed provisions and the rest of the Convention (Vogler 1995, 49), and participants at UNCLOS III experienced "one of the most dramatic reversals in American political history" (Ogley 1984, 239).

In a climate chilled considerably by Cold War tensions, the major powers of the time – the US and Soviet Union, with the support of several other influential industrialised maritime states – were keen to dampen enthusiasm for regulating areas of the oceans, primarily because they were eager to maintain their navigation rights (Vogler 1995, 48). Their enthusiasm for unbridled freedom in the high seas stood in stark contrast to the compelling three hour oration delivered in 1967 by Malta's Ambassador to the United Nations, Arvid Pardo. Dr Pardo advised the UN General Assembly that mineral resources derived from polymetallic nodules on the seabed had the potential to deliver a gross international annual income of approximately six billion US dollars, following 'rediscovery' of the nodules by American geologist John Mero (Mann Borgese 1999; Vogler 1995, 64). The Ambassador's dream was that the economic benefits derived from this mineral bonanza would be shared equitably among all the world's countries according to the principle of "the common heritage of mankind", a truly internationalist concept that looked beyond the interests of miners by taking the wider welfare of the international community into account. The common heritage of mankind principle was crafted and articulated in the 'Moratorium Resolution' (1969)[58] and the Declaration of Principles Governing the Seabed and the Ocean Floor (1970)[59], the latter stating that: "The sea-bed and ocean floor, and the subsoil thereof, beyond the limits of national jurisdiction (hereafter referred to as the Area), as well as the resources of the Area, are the common heritage of mankind" (Allen 2001, 613). It is worth noting that the Moratorium Resolution was adopted by a vote of 62 to 28 with 28 abstentions, indicating that almost half of the UNGA member states were unwilling to give their support to a resolution that declared a moratorium on resource exploitation activities in waters beyond national jurisdiction. Amongst those who voted against the resolution were Australia, Canada, France, Japan, the Netherlands, Norway, the Soviet Union, the United Kingdom and the United States (Brown 1983, 541).

[58] UNGA Resolution 2574, 24 GAOR Supp (No.30) at 11, UN Doc. A/7834 (1969), referred to as the Moratorium Resolution.
[59] *Declaration of the Principles Governing the Sea-Bed and the Ocean Floor, and the Subsoil Thereof, Beyond the Limits of National Jurisdiction*, GA Res. 2749 (XXV), UNGAOR, 25th Sess. Supp. No.28, UN Doc. A/8028 (1970).

Synonymous with calls for the common heritage of mankind principle to be codified in international law were efforts by the Group of 77 (the bargaining group representing developing States) for the creation of a ‘new international economic order’ (NIEO). Envisaged as a counter to the dominance of the industrialised States’ neoliberal economic order, the NIEO was premised on reformation of global commodity arrangements and later embodied in the UNGA Charter of Economic Rights and Duties of States (1974) (Brown 1983, 546). The disgruntled but numerically dominant developing States were resoundingly supportive of the Pardo proposal. They saw the common heritage of mankind principle as a crucial conceptual remodification of what they believed to be the threadbare and anachronistic doctrine of high seas freedom, one which would provide a counterweight to claims of unfettered access to seabed minerals espoused by the politically and economically dominant industrialised powers (Anand 1993, 80). The evolution of the common heritage of mankind principle as *lex ferenda* (developing law) fitted comfortably within the frame of the proposed new international economic arrangements (Ogley 1984, 86-87), and the Declaration of Principles pertaining to the seabed and its resources were reiterated in article 29, Chapter III of the Charter of Economic Rights and Duties of States (1974). The Group of 77 (G77) insisted the Principles expressed in the 1970 Declaration be legally binding rather than an arbitrary collection of morally authoritative suggestions for the development of domestic policies dealing with ocean uses. The majority of industrialised states, however, took every opportunity to reiterate their preference to retain the status quo throughout the 1970s decade of Convention negotiations (Brown 1983, 548-554).

In contrast to the enthusiasm of the G77, the industrialised States expressed deep concerns about the geopolitical hazards incumbent in what they believed to be excessive idealism underpinning the common heritage of mankind principle. This principle, together with suggestions for the creation of a universally munificent seabed agency to protect the common heritage of mankind, created varying degrees of anxiety among industrialised States and led to a flurry of unilateral policies and legislation acknowledging and codifying the right of states and citizens to appropriate mineral resources from the seabed beyond any nation's jurisdiction[60] (Brown 1983, 526). The powerful four of the time – France, Germany, the United Kingdom, and the United States – expressed their commitment to the conclusion and entry into force of a convention of the law of the sea which would give legal exactitude to the common heritage of mankind principle in the context of deep sea minerals. During the late 1970s they argued that their commitments were reflected in unilateral legislation which each state had devised as an interim measure until a law of the sea convention could be realised. Further, domestic legislation had been developed with the necessary modifications in mind, and each included references to, and elements of, the common heritage principle so as to be compatible with the law of the sea treaty once it emerged from its chrysalis (Brown 1983, 557).

Three of the powerful four have since ratified the LOSC – only the US is yet to do so. The US had come to the negotiating table representing the interests of potential marine mining entrepreneurs and pressing for a regime where exploitation would be on a 'first come first served' basis with international involvement limited to that of a claims registry with potential for a compensatory element for the benefit of the international community, including landlocked States (Vogler 1995, 66). The G77 had failed to impose a new international economic order, despite a string of tactical victories. As Friedheim (1999, 663) sagely observed, the failure to reach consensus: "...on NIEO principles intended to shape new international institutions and practices resulted in a Part XI of the Convention that was hardly worth the paper it was written upon." Further, the 1995 Part XI Implementing Agreement was "almost totally rewritten to reflect a market approach to the exploitation of deep-seabed minerals" therefore the "neoliberal economic order, for good or ill, prevailed" (Friedheim 1999, 663). Ambassador Pardo was later to express his disappointment with much of UNCLOS III and the shape of the final Convention (Vogler 1995, 50). In Johnston's view, the challenge of promoting a goal of cooperative global ocean management was compounded by the focus on national entitlement that was solidified at UNCLOS III. Equitable seaward extension of coastal

[60] The United States (1980), the Federal Republic of Germany (1980), the United Kingdom (1981) and France (1981), with similar decrees issued by the Soviet Union (1982) and Italy (1982) (Brown 1983, 526).

states' entitlements was achieved at the expense of an effective system of ocean management (Johnston 2002, 4).

Despite the dominance of the industrialised states, the common heritage of mankind rhetoric prevailed, even though the new internationalist economic yearnings of developing States did not. The Area and its resources were designated the 'common heritage of mankind' as reflected in Article 140 (1) of the Convention which states that activities in the Area shall be: "...carried out for the benefit of mankind as a whole, irrespective of the geographical location of States, whether coastal or landlocked, and taking into particular consideration the interests and needs of developing states..."(Vogler 1995, 65).

The Convention that eventually emerged from UNCLOS III negotiations is a regime for managing the majority of forms of human conduct within a geographical region, "...a multiple use regime for all ocean users on all important ocean uses" (Friedheim 1999, 663). As already alluded to, a relatively new debate has now emerged regarding the legal status of genetic resources appropriated from areas beyond national jurisdiction and, like other contentious issues surface in relation to global oceans governance, it has the potential to become yet another challenging and convoluted process to be played out in a legal minefield.

1992 United Nations Conference on Environment and Development (Rio Earth Summit)

In 1992, the attention of the international environmental community was captured by the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro. The Earth Summit, as the Rio conference was known, was hailed an "historic moment for humanity" by the Conference Secretary General, Maurice Strong. The attendance record and scope of the Earth Summit were unprecedented: 172,108 government representatives and 2,400 NGO representatives developed a raft of documents, declarations, conventions and agreements, including Agenda 21[61], the CBD,

[61] The full title is *Agenda 21: Programme of Action for Sustainable Development*

and the UN Framework Convention on Climate Change (UNFCC) (United Nations online 2004a).

Agenda 21 comprises 40 chapters addressing environmental issues and challenges identified as pressing at the time. Chapter 17 dealt explicitly with the marine environment and suggests a litany of principles, actions, and approaches including "sustainable use and conservation of marine living resources of the high seas" (17.1 [c]) and "preservation of habitats and other ecologically sensitive areas" (17.46 [f]) (Earth Summit 2004). Principle 15 of the Rio Declaration on Environment and Development – the 'Precautionary Principle' – is articulated in Chapter 17, which also prescribes application of "preventive, precautionary and anticipatory approaches so as to avoid degradation of the marine environment [and] to reduce the risk of long-term or irreversible adverse effects upon it" (17.22). Chapter 17 defines seven programme areas, all of which are underscored by the need to pursue precautionary, anticipatory and integrated approaches to marine and coastal area management and development:

1. Integrated management and sustainable development of coastal areas, including EEZs and territorial seas;
2. Marine environmental protection (which focuses on sources of marine pollution);
3. Sustainable use and conservation of marine living resources of the ***high seas*** (emphasis added);
4. Sustainable use and conservation of marine living resources under national jurisdiction;
5. Addressing critical uncertainties for the management of the marine environment and climate change;
6. Strengthening international, including regional, cooperation and coordination; and
7. Sustainable development of small islands.

(United Nations General Information 2004)

While not calling specifically for the creation of high seas MPAs, the third programme area - sustainable use and conservation of marine living resources of the high seas – focused on protection of the biodiversity of the water column and ocean floor in oceans and seas beyond the jurisdictional reach of coastal states. For example, Section 17.46 (f) calls for the preservation of “habitats and other ecologically sensitive areas [of the high seas]”; 17.46 (g) states the need to promote “scientific research with respect to the marine living resources in the high seas”; while 17.73 (f) appeals for the preservation of “rare or fragile ecosystems” in areas beyond national jurisdiction (United Nations 2004).

The 1992 Earth Summit signalled the arrival of the ‘macro-approach’ to environmental governance, as demonstrated by the number of participants and the volume of broad-reaching, eco-ethically based and morally suasive principles, norms, arrangements, and agreements that emerged. It also heralded the ascendency of global environmental NGOs in environmental governance discourse and inspired a new era of motherhood statements and grand visions of how an environmentally-focused and ‘eco-friendly’ global community might evolve. By the time the 2002 World Summit on Sustainable Development (WSSD) was held to mark the ten year anniversary of the Earth Summit and assess progress made toward the latter’s goals, the ‘macro-goal’ approach to environmental governance had become firmly entrenched in the environmental NGO’s collective psyche and discourse, that is, a pattern had emerged in fora addressing the conservation and protection of terrestrial and marine areas.

2001 Vilm Workshop: Managing Risks to Biodiversity and the Environment on the High Seas, Including Tools Such as Marine Protected Areas – Scientific Requirements and Legal Aspects

The 2001 Vilm Workshop was initiated and sponsored by the German Federal Agency for Nature Conservation and attended by government agencies representatives, scientific researchers, law and policy practitioners, NGO representatives, academics, intergovernmental organisation representatives, and convention secretariats from around the world. Germany was particularly keen to gauge the mood of discussions during its investigation into options for establishing a system of MPAs in the North East Atlantic under the 1992 Convention on the Protection of the Marine Environment of the North East Atlantic (OSPAR) (Vilm Expert Workshop 2001, 7).

The primary aims of the Vilm Workshop were to:

- Identify conservation needs and priorities in the high seas on a global scale;
- Review existing activities with the express aim of conserving valuable sites in ocean areas beyond national jurisdiction;
- Develop ideas on how to achieve a strong high seas protection regime; and
- Stimulate discussions at the ICP (which participants identified as an appropriate global forum) concerning the need for better oceans governance mechanisms with potential to contribute to the conservation of high seas biodiversity.

(Gjerde 2003a, 2; Vilm Expert Workshop 2001, 7)

Three distinct categories for potential high seas marine protected areas were identified (Vilm Expert Workshop 2001, 23):

1. Distinct ecosystems (for example, seamounts, hydrothermal vents, and cold seeps);
2. Individual species and the habitats they occupy for reproduction, feeding etc.; and
3. Scientific reference areas

Within these categories, Workshop participants identified seven case study categories that could be used to tease out approaches to protection and preservation of the marine environment – (i) seamount ecosystems; (ii) cold water corals; (iii) hydrothermal vents and their communities; (iv) deep sea fish; (v) seabirds; (vi) cetaceans; and (vii) unique scientific reference areas.[62]

Participants considered 'marine protected area' to be an umbrella term covering multiple management and use options. Rather than labour over definitions and semantics, they agreed the focus would be on identifying and exploring risks to high seas biodiversity

[62] Unique scientific reference areas (USRAs) are areas that have been studied intensively and as such, provide space and time references on which to base further research (Vilm Expert Workshop 2001, 15).

and risk management tools. With these objectives in mind, deliberations were channelled into three broad subject areas for dissemination and discussion: (i) science; (ii) policy; and (iii) law.

The first area addressed science-based arguments for high seas marine protected areas. Speakers presented research findings on the physical aspects of each of the seven case studies listed. This exercise gave participants an overview of the urgency underpinning protection of ocean areas beyond national jurisdiction.

The second area focused on policy issues. Representatives from the Commission for the 1992 Convention on the Protection of the Marine Environment of the North East Atlantic (OSPAR Convention), the International Whaling Commission (IWC), the Convention on Biological Diversity (CBD), the World Conservation Union (IUCN), WWF International, and the Australian Government reported on their respective organisation's efforts and activities concerning high seas MPAs (Gjerde 2003a, 3; Vilm Expert Workshop 2001, 20-26).

The third area addressed the legal aspects of creating high seas MPAs (Vilm Expert Workshop 2001, 20-30). Participants explored the efficacy of existing international laws and conventions, and despite varying opinions, the majority agreed that the LOSC provided the framework: "...for all action to conserve biodiversity and other components of the marine environment of the high seas" (Vilm Expert Workshop 2001, 15). Some participants were of the view that the concept of high seas marine protected areas contradicted the high seas freedoms articulated in the LOSC and as such, represented "an inappropriate assertion of jurisdiction and control" over an area deemed to be free to all (Gjerde 2003a, 3). Furthermore, those that supported this assertion considered the current suite of international instruments and organisations sufficiently robust to deal with human activities on the high seas, including those activities threatening biodiversity. In their view no new approaches or mechanisms were necessary (Gjerde 2003a, 3; see also Kotliar 2001).

Proponents of high seas MPAs described the flexibility of MPA management options from no-take through to multiple-use and emphasised the obligation of states to protect and preserve the marine environment irrespective of the geopolitical boundaries specified in Articles 119, 192, and 194(5) of the Law of the Sea Convention. This difference of opinion changed the direction and tone of the Workshop. Discussions digressed from analyses of the legal aspects of high seas MPAs to exploring the creation of an analytical framework within which to determine whether further risk management measures were needed to address threats identified during the scientific session, and if so, what form these measures might take (Gjerde 2003a, 4). This digression meant that the Workshop did not address the initial question of: "...*how* high seas MPAs might be created from a legal perspective and how they might work in practice" (Gjerde 2003a, 1; emphasis added), but rather *why*.

Despite the digression, the ensuing analytical framework discussion gave rise to the Vilm Methodology which was developed to enable practitioners to: (i) determine the degree of risk; (ii) decide whether this risk was being adequately addressed by the international community; and (iii) ascertain if there was an existing international organisation with competence to deal with these risks. Using seamounts as a test case, the methodology identified bottom trawling as the predominant risk to biodiversity; Articles 192, 194.5 and 119 of the 1982 LOSC as the relevant international instruments; and RFMOs and/or regional seas organisations as the first line of environmental and organisational defence. The CBD, the FAO, the ISA and the Intergovernmental Oceanographic Commission (IOC) were identified as the appropriate authorities for addressing anthropogenic impacts on seamounts.

Some Vilm participants were of the view that these organisations' competence could be bolstered through a UN General Assembly resolution modelled on the UN Driftnets resolutions (Gjerde 2003a, 4-5). Resolutions 44/225[63] and 46/215[64] call for voluntary

[63] UN General Assembly resolution 44/225 was adopted by consensus in 1989 following concerns about the use and impact of high seas driftnets. It recommended the following measures: (a) a moratorium on all large-scale pelagic driftnet fishing on the high seas by 30 June 1992, subject to a proviso that it would not be imposed on a region or, if implemented, could be lifted should effective conservation and management

measures to reduce the impact of driftnets on non-targeted marine species, a view in stark contrast to those who believed the ecological health of the high seas would be best served by a legally binding instrument.

Participants at the Workshop agreed in their key conclusions that:

1. The 1982 LOSC was the “bedrock” upon which all actions to conserve high seas biodiversity must be based (Vilm Expert Workshop 2001, 15).
2. Although international and regional organisations possess the capacity to deal with the bulk of high seas biodiversity issues, further action was deemed urgent and necessary.
3. Any process or mechanism employed to protect the biodiversity of the high seas must be cognisant of, and respect the rights of, legitimate high seas users, therefore an appropriate balance between the two must be found.
4. Regional action and regional organisations were thought to be the most appropriate starting point for protection of high seas biodiversity, although such organisations would need to demonstrate competency and political will, and be well-resourced.
5. The ICP was the most germane forum for discussion of high seas biodiversity issues.
6. All relevant parties (coastal and user states) must be included in consultations on risk management in order to achieve full compliance and avoid ‘free riders’.

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measures be taken to prevent the destructive impact of such fishing practices; (b) immediate action to reduce large-scale pelagic driftnet fishing activities in the South Pacific, with such activities to be halted by 1 July 1991(interim measure until appropriate conservation and management arrangements in the region were entered into); and (c) an immediate stop to any further expansion of large-scale pelagic driftnet fishing on the high seas in the North Pacific and all other high seas outside the Pacific Ocean, with the understanding that this measure will be reviewed subject to the same measures outlined in (a) (Internet Guide to International Fisheries Law 2004).

[64] UN General Assembly resolution 46/215 was the third in the series of driftnet resolutions and was adopted on 20 December 1991. It built on the measures outlined in resolution 44/225 and, on the basis that states had not been able to demonstrate that driftnets could be used without adverse impacts, proposed that the moratorium be implemented and a revised timetable set.

7. The following international organisations were considered the most relevant for high seas issue areas (although not necessarily the institutional vehicles for the designation of high seas MPAs):
   - Biodiversity: CBD
   - Living marine resources: the FAO
   - Mineral resources of the Area: ISA
   - Scientific research: the IOC
   - Shipping: International Maritime Organisation (IMO)
   - Comprehensive global action: UNGA (through a Resolution or special intergovernmental negotiating forum).
8. Other possibilities included:
   - Amendment or utilisation of an existing international agreement in order to protect and preserve high seas habitats and living resources; and/or
   - Negotiation of a new international agreement to protect and preserve high seas habitats and living resources (Gjerde 2003a, 7).

Scientific Consensus Statement on Marine Reserves and Marine Protected Areas

While the Vilm Workshop participants were arriving in Germany in February 2001, the American Association for the Advancement of Science released its Scientific Consensus Statement on Marine Reserves and Marine Protected Areas. Signed by 161 marine scientists and experts on marine reserves, the Statement was crafted following a two and a half year global research project on marine protected areas. Referred to as the Working Group on Marine Reserves, the group's mandate was to improve scientific understanding of marine protected areas and marine reserves. The Statement was also a response to requests from ocean stakeholders: "...for a succinct, non-technical [and] scientifically accurate summary of current… knowledge about marine reserves" (National Center for Ecological Analysis and Synthesis online 2003).

The Working Group analysed the "best available evidence" concerning ecological effects *within* reserve boundaries; ecological effects *outside* reserve boundaries; and ecological effects of reserve *networks*. Researchers reached a number of conclusions, including the following, and these were articulated in the Scientific Consensus Statement (National Center for Ecological Analysis and Synthesis online 2003):

- The need for reserve sites to be located in a diversity of habitats;
- The value of reserves for fisheries and biodiversity conservation;
- The efficacy of reserves for protecting resident species and habitat;
- The need to have dedicated monitoring and evaluative programs;
- The necessity of reserve networks for long-term conservation benefits;
- The need to recognise that reserves are one of a number of management tools; and
- That the existing body of scientific information provides ample justification for immediate implementation of fully protected marine reserves.

A dedicated media campaign ensured that the Group's 'message' on the value of marine protected areas was circulated around the globe, and its conclusions were used by MPA advocates to enhance their argument for more marine protected areas within and beyond national jurisdiction.

The 2002 World Summit on Sustainable Development (WSSD)

Ten years after the 1992 Earth Summit, the World Summit on Sustainable Development (WSSD) was convened in Johannesburg, South Africa. Participants gathered from around the globe to evaluate the rate of progress of the 1992 Earth Summit strategies over the intervening decade and discuss new measures and mechanisms for facilitating the Earth Summit's overarching mandate of sustainable development of natural resources. Approximately 25,000 government, business and NGO representatives, and over 100 heads of state participated in the 2002 WSSD, which was also overseen by a multitude of observers representing a wide variety of interests (Wapner 2003, 2).

While there was consensus that a degree of progress and institutional change had occurred since 1992, there was also a palpable sense of underachievement. Many believed that the expectations and ambitions of the Earth Summit had either not been realised, or were being undermined by significant and persistent problems and constraints. In the lead up to, and during the WSSD, many participants were of the view that efforts to implement conservation mechanisms had been constrained by fragmentation and lack of coordination among international conventions and institutions. They also believed there were serious shortfalls in compliance and enforcement mechanisms and poor implementation rates of the multitude of targets and timeframes identified at the 1992 Earth Summit (International Oceanographic Commission and Center for the Study of Marine Policy, University of Delaware 2001,19-20).

Curiously, marine issues were not included in the draft WSSD agenda despite the principles, objectives and suggestions for action identified in Chapter 17 of Agenda 21. Initially the architects of the 2002 WSSD had focused on issues relating to human health, water and sanitation, terrestrial biodiversity, and agriculture. Concerted efforts by a number of influential governments, NGOs, and UN agencies concerned about the marine environment oversight lobbied to ensure that marine issues were included in the final agenda under the theme of Oceans, Coasts and Islands (Global Forum on Oceans, Coasts and Islands 2004). The initial omission remains an odd oversight, especially when one considers that 70 per cent of the planet's surface is covered by ocean; that the health of the marine environment within many coastal state jurisdictions continues to decline despite the norm setting exercises of the 1992 Earth Summit; and that extensive media coverage of issues such as overfishing, overdevelopment of coastal areas for human habitation, and the impacts of climate change on the marine environment keep ocean issues high on the public's issue attention cycle. Appropriation of ocean resources is also an important part of coastal economies and livelihoods.

The WSSD Oceans, Coasts and Islands theme culminated in three major outcomes:

(i) The Plan of Implementation of the WSSD (the official negotiated text with the informal title of 'Type 1 outcome');

(ii) The Johannesburg Declaration on Sustainable Development; and

> (iii) Partnership initiatives forged to bolster the implementation of Agenda 21 (informally known as 'Type II initiatives') (Cicin-Sain et al 2002, v-vi).

Like its 1992 predecessor, the outcomes of the WSSD wove a rich tapestry of motherhood statements, recommendations, principles, objectives, targets and actions for improving the ecological condition of the planet and its inhabitants. Despite its late inclusion on the agenda, an enormous amount of time and energy was invested in oceans, coasts and small island developing states (SIDS) forums, and a fresh batch of temporal target were set in the belief that a desirable state of marine health might be achieved.

Although high seas MPAs were not explicitly addressed in the Johannesburg Plan of Implementation, the following paragraphs relevant to their establishment were inserted in Section 4: 'Protecting and managing the natural resource base of economic and social development' (Cicin-Sain et al 2004, 12):

> 30(d) Encourage the application by 2010 of the ecosystem approach, noting the Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem and Decision 5/6 of the Conference of Parties to the Convention on Biological Diversity.
>
> 32(a) Maintain the productivity and biodiversity of important and vulnerable marine and coastal areas, including in areas within and beyond national jurisdiction.
>
> 32(c) the establishment of marine protected areas consistent with international law and based on scientific information, including representative networks by 2012 and time/area closures for the protection of nursery grounds …

According to Morgera (2007, 3), while several countries interpret the goal of 32(c) as calling for the establishment of a 'global network' of MPAs within and beyond national jurisdiction, other countries object to that interpretation. They are of the view that the goal refers to a plurality of 'networks and the associated implication that this includes multiple areas within national jurisdiction. Morgera argues that the supporters of a 'global network' of marine protected areas:

> ...justify their interpretation on the basis of a combined reading of WSSD commitments to maintaining the productivity and biodiversity of important and vulnerable marine and coastal areas, *including beyond areas of national jurisdiction*, and to developing international programmes for halting the loss of marine biodiversity (Morgera 2007, 3).

The reference to international law in 32(c) and the requirement of consistency no doubt appealed to high seas MPA advocates and clearly afforded a degree of legitimacy for the macro-goal of *a global representative system of MPAs by 2012* (see Chapter Seven for an analysis of the concept of 'legitimacy'' in the context of international environmental agreements). As identified in Chapter Three, boundaries in complex adaptive systems are arbitrary and subjective, including the boundaries of interpretation of text. Boundaries are also an issue for discussions regarding the concept of *ecosystems.*

The 'ecosystem approach' referred to in paragraph 30(d) together with a number of other paragraphs in the Plan of Implementation proved to be contentious and controversial. Following spirited negotiations between delegations it was deleted from the introductory chapter of the Plan of Implementation although it remained in the body of text because of its linkages with biodiversity. In the aftermath of WSSD, the IUCN noted that because the term *ecosystem* had not yet been universally accepted beyond the CBD it required "the development of operational and methodological guidelines in order to show its practical effectiveness" (IUCN 2003b, 6). It remains, however, an essentially contestable construct and both definition and intent are perpetual items of contention at almost every Conference of Parties to the Convention on Biodiversity.

Conclusion

This chapter provided some historical context and background to the rise of macro-goals and concepts that have been driven by actors with firmly embedded eco-ethical internal models and who are involved in international environmental fora. The summaries of meetings identified as central to the emergence of the high seas epistemic community also reveal regularities, repetitiveness and relationships which, when analysed retrospectively through the *cas* paradigmatic lens, demonstrate patterns of behaviour relating to high seas MPA discourse. The *cas* 'basics' and oceans governance parallels are depicted simplistically in Table 3.

The tags, building blocks and internal models of eco-ethical ideology have created a multitude of environmental epistemic communities, not least because complex adaptive systems are characteristically self-organising and the tags that are used repeatedly serve as signposts that attract like-minded agents. The emergence and evolution of macro-goals, which have since evolved into a collection of tags and building blocks, can be traced back to the 1972 UNCHE which brought together a multitude of actors and institutions concerned about the impacts of human activities on the natural environment. Until the UNCHE, environmental NGOs had been relatively small, both financially and terms of numbers and membership. A decade later, more than 100 had been accredited as observers at multilateral conferences (Johnston 2001, 11) and financial membership has flourished. Since the early 1970s, environmental institutions have had ample opportunities to learn the 'rules' of the multi-lateral governance game, and, as demonstrated in this and the next chapter, have applied the lessons derived from observation to more practical use with considerable success.

Table 8: *cas* 'basics' (Holland 1995) and global oceans governance parallels

***cas* 'Basics'**	**Global oceans governance parallels**
Aggregate	High seas epistemic community
Internal model	Environmental sustainability Protecting deep oceans biodiversity
Building blocks	1982 Law of the Sea Convention CBD Principles Marine protected areas
Tags	*A global representative system of MPAs by 2012* Precautionary Principle Ecosystem approach

To understand systems behaviours, *cas* scholars identify leverage points that have contributed to large directional changes in the system. The 1982 LOSC was a significant geopolitical leverage point, as was the UNCHE in terms of the expression of macro-goals in multilateral fora. Each of the meetings described in this chapter represent small leverage points that have contributed to significant changes in the language of global oceans governance. The next chapter demonstrates the impact of these leverage points on discussion concerning the protection of deep oceans biodiversity in more 'formal' international governance fora.

In *cas* terms, this chapter has presented an overview of the short run horizontal interactions that can be used to identify subsystem behavioural patterns (the high seas epistemic community). The next chapter discusses the flows of information that filter up through the longer run vertical interactions to 'higher' hierarchical levels of the system such as the UNGA and Conferences of Parties to the CBD, and the impact that this has had on high seas MPA discourse at these levels.

CHAPTER FIVE

THE INFLUENCE OF THE HIGH SEAS EPISTEMIC COMMUNITY ON HIGH SEAS MARINE PROTECTED AREA DISCOURSE: 2003-2008

Introduction

The levels of the global oceans governance hierarchy represent various action settings within the global oceans governance *cas*. As emphasised in Chapter Three, descriptions of any complex adaptive system's hierarchical organisation can be compressed – by eliminating peripheral details, the structure of the global oceans *cas* can be described as a system of basic constituent parts which interact in a multitude of combinations. For this reason, it would be extremely difficult, perhaps impossible, to construct a diagram of the hierarchical organisation of the global oceans *cas* because of the highly subjective nature of issues and where they might 'rank' on the issue attention agenda at any particular time, the diversity of agents and agendas circulating within and moving between systems and subsystems, and the perpetually novel relationship dynamics. The global oceans *governance* cas is so much more than the sum of its constituent parts - a snapshot of the system taken today, would have little resemblance to the global oceans governance *cas* of a decade ago, nor what it might look like in ten year's time. Nonetheless, Appendix 1 represents a 'snapshot' of sorts of the governance measures and mechanisms that have emerged from the global oceans *cas* over several decades. The list is extensive but far from exhaustive because of the perpetual novelty of complex adaptive systems – as explained in Chapter Three, stasis is not a characteristic of the *cas* paradigm. Appendix 1 is merely a glimpse of some of the policy, regulatory and legal components of the global oceans governance system.

Chapter Three established that the physiology of a *cas* can be understood by exploring the connectivity – the relationships – between its parts, rather than analysing each part in isolation (Gallagher and Appenzeller 1999, 79). Over time these patterns of interaction manifest in emergent phenomena that are observable at the macro level even though they are generated by agents at the micro-level (Seel 1992; Parvard and Dugdale 2005). Chapter Four looked at the emergence of the high seas epistemic community at the micro- and meso-levels, and how the objectives of the community – generated through repeated use of tags and building blocks informed by eco-ethical internal models – gathered momentum and were 'legitimised' at the 2002 WSSD.

This chapter looks at how the patterns of behaviour have manifested in emergent phenomena at the macro level. The United Nations' Informal Consultative Process on Oceans and Law of the Sea, and Ad Hoc Open-ended Informal Working Group (which studies issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction) report to the United Nations General Assembly. The CBD's Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity (SBSTTA), and the Ad Hoc Technical Expert Group on Marine and Coastal Protected Areas (AHTEG) report to the CBD Conference of Parties. While these groups report to agents at 'higher' levels of the global oceans governance hierarchy, they remain autonomous and discrete in the information they access, consider, examine, and filter through to the upper levels. They act as conduits between actors at the micro-level (for example, the high seas epistemic community) and the macro-level. This chapter describes the flurry of activities, interactions and relationships – the action settings – around high seas governance, including MPAs, from 2003 to 2008, although activity slowed somewhat after 2005. It also demonstrates the increasing frequency – repetitiveness – of the high seas epistemic community's priority social goal and primary tag.

As Chapter Three explains (and Chapters Four and Five confirm), one of several universal themes in descriptions of complex adaptive systems is that basic components and laws (rules) interact more or less simultaneously within the self-organised complex adaptive system and that multiple options for interaction are also presented by the system itself (Waldrop 1992, 86). Each agent, aggregate, and subsystem within the global oceans governance *cas* operates according to fundamental rules of organisation and communication. The accreditation of international environmental NGOs as observers (and sometimes government advisors) at multilateral meetings, provides them with multiple options for interaction with a diverse range of actors while adhering to the basic laws of the system.

Action Settings for High Seas Conservation and Governance Issues

The IUCN, WCPA and WWF Experts Workshop on High Seas Marine Protected Areas, Malaga, Spain 2003 (the Malaga Workshop)

The Malaga Workshop, convened by key environmental NGO players in the high seas epistemic community (IUCN, WWF and WCPA), brought together 38 marine experts from the fields of law, science, policy, and management representing a diverse array of institutions and organisations. The Workshop's primary objective was to: "develop an action plan to promote a system of high seas protected areas to ensure long term protection and wise use of ecosystem processes, biological diversity and productivity beyond national jurisdiction" (Kelleher 2003, 3). Speakers addressed the state of global oceans governance, scientific research data, progress being made by both the German and Australian governments in promoting high seas MPAs, the promotion of 'Unique Scientific Priority Areas' (long term study sites), and the protection of fragile coral communities, seamounts and hydrothermal vent systems in areas within and beyond national jurisdiction (Kelleher 2003, 4).

Armed with this information, Workshop participants were then assigned two major tasks. The first was to draw a "road map" for high seas MPAs by identifying the most pressing ocean conservation issues, high seas stakeholders, and interested parties. The second was to identify "mechanisms, gaps, messages, a timeframe, opportunities and funding issues" and develop promotional strategies for the concept at both individual site and representative system levels (Kelleher 2003, 4).

Participants explored a number of questions deemed important in resolving the two primary tasks and came up with an extensive list of conclusions and recommendations for road map design and strategic development of high seas MPAs. These were expressed in four specific groups of action plans: (i) global instruments and institutions; (ii) global fisheries instruments and institutions; (iii) regional arrangements and legal framework; and (iv) potential priority sites/opportunities. Each action plan addressed the steps to be taken, steps-within-steps, target audience, actors involved, work schedule, resource needs, and possible funding sources (IUCN 2003).

In the context of a legal framework for high seas MPAs, the Malaga participants identified three priority actions: (i) coalition building/networking; (ii) international recognition of the concept of high seas MPAs through the utilisation of international and regional fora; and (iii) designation of pilot site high seas MPAs to serve as 'test cases' to expedite future high seas MPA design, management and enforcement (Gjerde 2003b, 2, 8-19). As the third priority action suggests, the Malaga Workshop ventured far deeper into the domain of pragmatism than its predecessors. Participants identified a series of practical steps toward the development of a system of high seas MPAs. Based on the evidence presented in a Scientific Background Paper provided to Workshop participants, the following areas were identified as areas for further research (Gjerde 2003b 20-21):

(i) Arctic Mid-Ocean Ridge/Gakkel Ridge hydrothermal vents;
(ii) Antarctic Seamounts;
(iii) Central Indian Ocean Ridge seamounts and hydrothermal vents;
(iv) Mid-Atlantic Ridge vent fields;
(v) Lord Howe Seamount chain;
(vi) The European Deep Seas Transect (within the Maritime Area of the OSPAR Convention, and proposed as a Unique Science Priority Area); and
(vii) The Rockall Bank coral communities in the North East Atlantic.

The following sites were identified as politically feasible high seas MPAs and an action plan developed for each (Gjerde 2003b, 21):

(i) Tasman seamounts (off the southern coast of Australia);
(ii) Grand Banks (off the east coast of Canada);

(iii) Keguelen Island and Heard Island-McDonald Islands (which border Australian and French Antarctic territories);

(iv) Logatchev Vent Field (mid-Atlantic Ridge);

(v) Great Meteor Seamount (the world's largest isolated seamount located in the North Atlantic); and

(vi) Rainbow vent field (Mid-Atlantic Ridge, and also within the OSPAR Maritime Area).

The draft action plan for the Rainbow hydrothermal vent field is at Appendix 2. It sets out the elements identified at the Malaga Workshop to establish the Rainbow hydrothermal vent field as a high seas MPA (IUCN 2003).

A number of steps to designating a high seas MPA pilot site were also outlined. The drafters emphasised that the process would require "a broad based collaborative effort, with many iterative steps requiring adaptation to regional and local needs and capabilities" (Gjerde 2003b, 21). The Steps were based on precedents for MPA designation recommended at the domestic level (Gjerde 2003b, 21-22):

(i) Select candidate sites;

(ii) Promote, consult and find funding sources;

(iii) Identify the relevant authorities and stakeholders;

(iv) Gather technical, legal, and scientific background information;

(v) Prepare the proposal in the form of a white paper;

(vi) Examine the legal mechanisms with utility for high seas MPAs;

(vii) Consider the social, political and economic realities which will determine the success or failure of such a proposal;

(viii) Finalise the MPA proposal premised on detailed socio-economic, technical and legal analysis and a conservation report;

(ix) Prepare a management plan;

(x) Implement the designation process;

(xi) Implement the management plan and enforce; and

(xii) Monitor and evaluate the site to gauge success.

Workshop participants also explored the existing legal framework and alternative options such as voluntary agreements and to monitoring and enforcement issues, noting in relation to the latter that technological developments such as satellite surveillance and transponders were improving the capacity for effective enforcement of state's international legal obligations (Gjerde 2003b, 23-24).

In conclusion, participants agreed that urgent action to halt threats to high seas biological diversity and productivity was needed. In addition to the four clusters of action plans developed during the Workshop, they also emphasised the need to find immediate mechanisms for seamount protection and noted the need to explore avenues for expediting implementation through the existing oceans governance legal framework. The majority also expressed "a high degree of enthusiasm and willingness" to participate in implementation of the Action Plans (IUCN 2003a).

As noted in Chapter Four, the *global representative system of marine protected areas by 2012* goal was legitimised in the eyes of MPA proponents at the 2002 (WSSD). The Proceedings of the Malaga Workshop announced that:

> ...finally, it appears that High Seas MPAs are "an idea whose time has come." Following the WSSD and in light of the work being undertaken by the CBD and United Nations Division on Ocean Affairs and Law of the Sea (UNDOALOS), there appears to be significant momentum toward future motion in relation to marine biodiversity protection as well as clear recognition of the need for new tools to manage risks to biodiversity on the high seas (IUCN 2003a).

Workshop on the Governance of High Seas Biodiversity Conservation, Cairns, Australia, 2003

The Cairns Workshop on the Governance of High Seas Biodiversity was the result of a partnership initiative forged at the 2002 WSSD between the governments of Australia, Canada, the UK, Cambodia, New Zealand, and the US, together with the IUCN, the WWF, Humane Society International, the ISA, the IMO, the International Oceans Institute (IOI), and FAO (Cairns Workshop Summary Record 2003). Participants were reminded of Paragraph 32 (a) of the Johannesburg Plan of Implementation, and UNGA Resolution 57/141 which provided impetus for discussion by encouraging:

> [R]elevant international organizations, with the assistance of regional and subregional fisheries organizations, to consider urgently ways to integrate and improve, on a scientific basis, the management of risks to marine biodiversity of seamounts and certain other underwater features within the framework of the United Nations Convention on the Law of the Sea (Cairns Workshop Summary Record 2003.)

The overarching goal of the Cairns Workshop was the conservation of high seas biodiversity through intellectual capacity building. Over 150 participants representing 36 countries and a broad range of institutions and scientific research disciplines attended the Workshop to identify and examine activities threatening high seas biodiversity. Although fishing practices such as bottom trawling were identified as the most destructive of high seas activities, the impacts of mineral exploration, military activities, dumping of toxic materials, scientific research, ocean debris, introduced marine pests, whaling, bioprospecting, and the laying and operation of submarine cables and pipelines were also addressed during the four day Workshop. Motivated by the normative principles of intergenerational equity, integrated ocean and coastal management, and the precautionary approach, workshop attendees teased out the utility of traditional and newly identified options and actions with potential to protect high seas biological diversity. Once again, the 1982 LOSC was endorsed as the primary legal foundation upon which measures and actions for the protection of high seas biodiversity should be built (Cairns Workshop Meeting Record 2003).

Participants categorised the various options according to their utility in the short, and medium to long terms. Immediate options (1-5 years) placed the United Nations at the forefront of actions and include, *inter alia*:

– A call for a UNGA resolution for a moratorium on destructive fishing practices;
– A call for a UNGA resolution addressing issues relating to the genuine link between vessels and flag states;
– A call for an “appropriately resourced” coordination and cooperation mechanism within the UN system;
– Urgent capacity building for small island developing states and less-industrialised countries;

- Public relations campaigns emphasising the value and importance of the deep ocean system;
- Development of a pilot high seas marine protected area site; and
- Relevant organisations such as the UNGA and the CBD Secretariat to address and review issues pertaining to the conservation and sustainable use of deep seabed genetic resources.

  (Cairns Workshop Summary Record 2003).

Medium to longer term options (5-20 years) were divided into categories addressing: (i) international law; (ii) institutions; (iii) scientific research; and (iv) education and capacity building. International legal options included:

- Development of agreements to ensure implementation of the LOSC conservation obligations;
- Amendment of the World Heritage Convention to include the high seas;
- Amendment of the CBD to: "provide a framework for the establishment of marine protected areas and ecosystem-based management for the oceans and seas beyond national jurisdiction"; and
- Development of a framework within which to address bioprospecting and other activities not specifically regulated by extant agreements or institutions.

  (Cairns Workshop Summary Record 2003)

Institutional options included:

- Encouraging greater use of existing IMO measures such as particularly sensitive sea areas (PSSAs) and special areas (SAs) among IMO member states, and for the IMO to develop new measures to protect high seas biodiversity;
- Expanding the scope of the ISA beyond seabed mineral management to include designation of high seas conservation zones, and to develop a regime for bioprospecting in the Area based on the principles expressed in the LOSC and the CBD;
- Improving coordination between oceans-relevant conventions and instruments;
- Establishing new high seas-specific RFMOs;

- RFMOs establishing high seas MPAs;
- Development of a central authority for management of the oceans;
- Development of an ‘Oceans Interpol’; and
- Development of a global biotechnology commission.

  (Cairns Workshop: Summary Record of Discussion and Suggestions for a Way Forward 2003)

Scientific research options included:

- Establishment of a Global Marine Assessment that includes high seas biodiversity issues;
- The IOC to act as coordinator between oceans policy and scientific communities;
- Identification of vulnerable ecosystems, especially candidate sites for MPAs; and
- Creation of regional and global ocean governance research networks to inform high seas biodiversity conservation decisions.

  (Cairns Workshop Summary Record of Discussion and Suggestions for a Way Forward 2003)

Education and capacity building options included:

- Inspiring public and stakeholder awareness of those problems and challenges identified in previous options categories;
- Expanding intellectual capacity through training and education; and
- Increasing the utilisation of communications technologies to convey the message about high seas biodiversity conservation.

(Cairns Workshop: Summary Record of Discussion and Suggestions for a Way Forward 2003).

Other ideas proposed at the Workshop included the development of a Global Oceans Policy, and the creation and appointment of a Global Oceans Ambassador (Cairns Workshop Summary Record of Discussion and Suggestions for a Way Forward 2003).

Fifth IUCN World Parks Congress 2003

The IUCN World Parks Congress (WPC) is held every ten years and is recognised as a major global forum for discussion and debate on the threats, issues and challenges to the world's ecological domains, and potential solutions including protected areas. The Fifth WPC, held in 2003, was attended by 2,500 government officials, scientists and environmentalists who participated in discussions on a number of cross-cutting themes, the first of which addressed areas of concern relating to protection and preservation of the marine environment (World Wide Fund for Nature (a) 2004). In light of these concerns, the WPC recommended that at least 20 to 30 per cent of all marine habitats be included in networks of marine reserves, an area that participants viewed as conservative following a review of "nearly forty studies examining how much of the sea should be protected". The majority of these studies had concluded that "between 20 and 50 per cent *should* be protected to achieve the conservation of viable populations, support fisheries management, secure ecosystem processes and assure sufficient connectivity between marine reserves in networks" (Gell and Roberts 2003).

A special planning session for high seas MPAs was held during the Congress and a small and dedicated group of participants (key members of the high seas epistemic community) discussed the construction of a theoretical framework for a high seas representative system of MPAs, enforcement challenges, the organisational framework for a high seas coalition, and the need to engage stakeholders during all stages of the process (IUCN 2004a).

The WPC's visionary statement was massaged into a document titled the *Durban Accord* which implored actors in the global oceans governance *cas* to embrace a litany of political, legal and institutional commitments for the protection of marine biodiversity. Delegates reiterated the temporal targets established during the 2002 WSSD in relation to marine biodiversity protection, and emphasised the inclusion of ocean areas beyond national jurisdiction in the 2012 global marine protected areas network target. This goal was also echoed in the Congress Message to the Convention on Biological Diversity (IUCN 2004a), further reinforcing the high seas epistemic community's priority social goal.

The Durban Accord specified ten Outcomes to be augmented by actions at international, regional, national and local levels. In particular, Outcome 3 envisaged achievement of a "global system of protected areas linked to the surrounding landscapes and seascapes", and identified a number of ecosystems in need of attention, including those of the high seas where the priority was to "develop a linked, coordinated and consistent system of management, including protected areas [involving] international collaboration amongst RFMOs" connected to "parallel and complementary initiatives in coastal waters and EEZ seas" (IUCN 2004a).

The centrepiece of the WPC marine theme was Recommendation 5.23: Protecting Marine Biodiversity and Ecosystem Processes through Marine Protected Areas beyond National Jurisdiction (hereon referred to as Recommendation 5.23). It called for the international community to collectively endorse and promote:

> ...the goal of establishing a *global system* of effectively managed, representative networks of marine protected areas by 2012 that includes within its scope the world's oceans and seas beyond national jurisdiction, consistent with international law...[and to] utilize available mechanisms and authorities to establish and effectively manage by 2008 at least five ecologically significant and globally representative high seas marine protected areas incorporating strictly protected areas consistent with international law and based on sound science to enhance the conservation of marine biodiversity, species, productivity and ecosystems (IUCN Recommendation 5.23 in Morgera 2007, 3).

In addition to identifying a new and ambitious target – a minimum of five high seas MPAs by 2008 – Recommendation 5.23 also restated a number of previously articulated commitments and temporal targets, including Resolution 2.20 (Conservation of Marine Biodiversity) adopted at the 2nd World Conservation Congress in Amman, Jordan (2000), and the temporal targets described in the 2002 WSSD Johannesburg Plan of Action. In a similar vein to that of Recommendation 5.23, Resolution 2.20 urged global actors to seek ways of protecting marine biodiversity, including high seas MPAs, and called on "national governments, international agencies and the non-governmental community to better integrate established multilateral agencies and existing legal mechanisms to identify areas of the high seas suitable for collaborative management action" (Anon, 2004; IUCN 2004a).

Opinions on the 2008 temporal target ranged from "ambitious and doable" to "a miracle" if attained, although the latter was qualified by the belief that support for high seas MPAs was gathering momentum and, as such, was a matter of 'when' rather than 'if' (Anon 2003, 1).

Recommendation 5.23 conveyed eight proposals to the international community which affirmed, *inter alia*, the sentiments previously expressed in Resolution 2.20 coupled with the WSSD Plan's 2012 benchmark for a global representative system of MPA networks. It called for the establishment and effective management of five "ecologically significant and globally representative" high seas MPAs by 2008, and introduced the IUCN-World Commission on Protected Areas' (WCPA) Ten Year Strategy to Promote Development of a Global Representative System of High Seas Marine Protected Area Networks (herein known as the Ten Year Strategy).

The WCPA Ten Year Strategy

The 5th WPC drew the high seas epistemic community together to discuss ideas built on shared eco-ethical internal models that had shaped its priority social goal of protecting deep oceans biodiversity, and develop further its suite of building blocks for the creation of marine protected areas beyond national jurisdiction. .

The primary aim of the WCPA Ten Year Strategy (2003-2012) is to promote the concept of high seas MPAs through seven core components identified by Marine Theme participants at the WPC, and supported by a number of strategic steps. The following is a substantially abridged version of these seven core components and key strategies (IUCN 2004b, 3-7):

1. Endorse and promote the WSSD Joint Plan of Implementation with an emphasis on the 2012 temporal goal of a global system of representative networks of MPAs.

2. The UNGA to consider immediately a ban on deep sea trawling in high seas areas, with attention directed toward seamounts and cold-water coral communities.
3. Establishment and effective management of a minimum of five scientifically significant and globally representative high seas MPAs through binding and non-binding agreements. This component also calls for the development of "explicit proposals for pilot [high seas] MPAs while plans for a representative system of … networks are under development."
4. Establishment a global system of representative networks of MPAs.
5. Identification of marine ecosystems, habitats, areas, processes and biodiversity hotspots for immediate attention.
6. States to respect and adhere to formal and informal international agreements such as the LOSC, CBD), FSA) and the Convention on Migratory Species (CMS) so that a global framework for a holistic representative system of high seas MPAs can be developed and promoted.
7. Continue promoting the global representative system of high seas MPAs and report on progress at the International Marine Protected Area Congress (IMPAC) (held in Australia in 2005).

The Strategy also includes a number of "tool boxes" to complement the seven components and strategies. Tool Boxes One and Two explore the support structures and strategies that could be used to shore up support for high seas biodiversity conservation measures including international and regional forums and agreements; international environmental laws; voluntary codes of conduct; non-binding Memorandums of Understanding (MOU) amongst 'range states'; establishment of a biosphere reserve; public/private partnerships; and joint plans of action or work programmes between conventions such as the CBD and CMS (IUCN 2004b, 9-12). Tool Box Three describes potential preliminary criteria for high seas MPAs, while the fourth Tool Box defines the ecological research elements which are relevant to both development and management of a global representative system of high seas MPA networks.

Following on from the WCPA's Ten Year Strategy, WCPA-Marine drafted a *Plan of Action* for 2006-2012 (Laffoley 2006). The mission for the Plan of Action is: "...to promote the establishment of a global, representative system of effectively managed and lasting networks of MPAs, as an integral part of the IUCN mission" (Laffoley 2006, 7). Underpinning the mission statement are the temporal targets agreed at the 2002 WSSD, including:

- Halting the decline of biodiversity by 2010;
- Encouraging the application of the ecosystem approach in marine management by 2010;
- Establishing representative marine protection networks by 2012; and
- Restoring depleted fish stocks to maximum sustainable yields by 2015 where possible (Laffoley 2006, 6).

The centrepiece of the Plan of Action is marine protected areas. While acknowledging that MPAs are not an end in themselves, the Plan of Action states that they are essential for the protection of marine biodiversity (2006, 7), and adds that they are:

> ...insurance against the common global problem of failure of conventional fisheries management based on control of fishing effort and/or take. The contrasting combination of the physical connectivity of seawater combined with the increasingly known genetic isolation of marine species means that networks of MPAs are vital tools to support marine ecosystem health. Networks of MPAs, within single ecosystems but spanning entire seas and ocean realms (such as the High Seas), are necessary to ensure that biological connections are maintained between interdependent MPAs. A common example is where larvae from one MPA supports populations of one or more species within other MPAs (2006, 7).

The WCPA also established a High Seas MPA Task Force with its own Plan of Action. Underpinned by the WCPA Ten Year Strategy, the Task Force's mandate included working with governments, scientists, international organisations and other stakeholders to "promote the establishment of five pilot MPAs by 2008 and MPAs in five oceanic basins by 2010" (WCPA - Marine 2006), As of 2010, however, neither the pilot MPAs nor MPAs in the oceanic basins have been created.

WCPA – Marine grouped the major challenges to the creation of high seas MPAs into three categories:

1. Addressing legal gaps, because the legal framework for establishing high seas MPAs is "fragmented and incomplete, particularly with regard to cumulative impacts" (WCPA Marine 2006).
2. Addressing scientific gaps and improving data collections on species and habitat distribution, abundance and endemism.
3. Gaining practical experience as there is "little experience with the practicalities of designating, managing, monitoring or cooperatively enforcing high seas MPAs", hence the proposal for five pilot MPAs in areas beyond national jurisdiction.

   (WCPA – Marine 2006)

Complementing the Ten Year Strategy and Plan of Action are the IUCN's Ten Principles for High Seas Governance, introduced at the 2008 IUCN World Conservation Congress in Barcelona to "stimulate progress on the large volume of oceans treaties and declarations agreed to but rarely acted on" (IUCN 2008a). The principles are:

1. Conditional freedom of activity on the high seas;
2. Protection and preservation of the marine environment;
3. International cooperation;
4. Science-based approach to management;
5. Public availability of information;
6. Transparent and open decision making processes;
7. Precautionary approach;
8. Ecosystem approach;
9. Sustainable and equitable use; and
10. Responsibility of States as stewards of the global marine environment (IUCN 2008).

The Campaign to Protect the Geomorphic Features of the Ocean Floor – The Coos Bay Statement of Concern (2003)

Over 100 scientists attended the 10th Deep-Sea Biology Symposium at Coos Bay, Oregon in October of 2003. Responding to evidence indicating increasing anthropogenic impacts on deep-sea habitats, participants released a "Statement of concern to the United Nations General Assembly regarding the risks to seamounts, cold-water corals and other vulnerable ecosystems of the deep-sea", informally referred to as the Coos Bay Statement of Concern. Accompanied by a list of 142 signatories and an official letter, the Statement was presented to the UN Secretary General for consideration in October 2003.

The Statement emphasised signatories' concerns about the: "...lack of effective international regulations for the conservation of natural systems and the protection of the biodiversity of the … High Seas as well as within areas of national jurisdiction" (Coos Bay Statement of Concern 2004). It presented a number of conclusions regarding threats to the ecological health of the oceans' living marine resources, habitats, and geomorphic features such as seamounts and hydrothermal vent systems. The Statement also made the following calls and declarations:

- All nations are responsible for the conservation and protection of the biodiversity of the high seas;
- Non-commercial scientific research should be encouraged in order to better understand the ecosystem processes of the deep oceans;
- Reiterate the WSSDs call for development of representative networks of marine protected areas at global, regional and national levels;
- Designation of 'Science Priority Areas' for baseline research;
- UN General Assembly to implement immediately a moratorium on bottom trawling in the high seas; and
- All regulations to conform to the 1982 LOSC and other relevant instruments.

(Coos Bay Statement of Concern 2004).

The Greenpeace Roadmap to Recovery: a proposal for a global network of marine reserves on the high seas

Building on work already undertaken by the high seas epistemic community, Greenpeace released a *Roadmap to Recovery* (2006) that included calls for between 20 and 50 per cent of the high seas to be designated strictly no-take MPAs. The Report presented a design for a global network of high seas marine reserves with the highest levels of protection. To inform the design, Greenpeace brought together biological, physical and oceanographic data and mapped it using a geographic information system divided into 5º latitude by 5º longitude grids representing the size of the smallest marine reserves Greenpeace considered viable for the high seas (Roberts, Mason and Hawkins 2008, 7). Based on this data, Greenpeace determined a target of protecting 40 per cent of all habitats and biogeographic zones in areas beyond national jurisdiction (2008, 8). To achieve the 40 per cent target, Greenpeace decomposed the high seas into features addressing ocean area biogeographic zones, bottom types, fauna and oceanography, and then identified the amount of each feature included in the 'network' and the number of grid cells in each of the features. This information then enabled Greenpeace to select 25 significantly large ocean areas for protection (Roberts, Mason and Hawkins 2008, 33-39).

The Roadmap also established five "principles of marine reserve networking" (Roberts, Mason and Hawkins 2008, 25). According to Greenpeace, a network *should*: (i) be representative of the full range of biodiversity; (ii) replicate habitats in different marine reserves; (iii) be designed to ensure that populations in different reserves can interact and be mutually supporting; (iv) be sufficiently large to ensure long-term persistence of species, habitats, ecological processes and services; and (v) be based on the best available scientific, local and traditional knowledge (Roberts, Mason and Hawkins 2008, 25). Finally, following consultation with marine science and policy experts from around the world, the Roadmap lists numerous suggestions for candidate high seas MPAs, which includes a mix of geomorphic features, gyres, seeps, fronts, convergence zones, upwellings and seas.

Beneath the United Nation's Broad Umbrella

Overview

This section provides evidence of the scope of influence of the high seas epistemic community, its primary tag and the impact on the level III institutions in the global oceans governance *cas*, namely the United Nations General Assembly and the Convention on Biological Diversity Conference of Parties and subsidiaries. It describes the smaller aggregates set up under the rubric of the United Nations to examine high seas biodiversity issues and potential protection mechanisms, how these groups work at the policy/science interface, and the long run vertical flows of ideas, information, terminology, priority social goals, and the primary tag of *a global representative system of MPAs by 2012* generated by environmental NGOs and the high seas epistemic community in particular, has permeated the higher hierarchical levels of the global oceans governance *cas*.

The United Nations Open-ended Informal Consultative Process (ICP)

Within the United Nation's vast realm, a number of agencies and sub-groups (aggregates) are components of the global oceans governance *cas*, although few address the issue of high seas marine protected areas directly. As noted in preceding chapters, the ICP is one of the working groups created under the UN banner that devotes time and resources to the concept of high seas biodiversity protection and governance.

The ICP was created as a result of a recommendation to the UNGA in 1999 by the Commission on Sustainable Development (CSD) following a review of the progress of Chapter 17 of Agenda 21[65]. It was agreed that an informal consultative process would facilitate deeper and more open consideration of ocean affairs and provide a forum where the most pressing marine environment issues could be identified and prioritised without the constraints imposed by more formal UNGA proceedings (UNDOALOS 2004, 2).

[65] At its first session in 1993, the Commission on Sustainable Development (established after the 1992 UNCED Earth Summit) initiated a programme to review all 40 Chapters of Agenda 21 (Rogers 2004, 2).

The ICP was charged with the execution of three interrelated tasks: (i) examining developments in oceans affairs consistent with the legal framework provided by the 1982 LOSC and the goals articulated in Chapter 17 of Agenda 21; (ii) identifying pertinent oceans issues for consideration by the UNGA; and (iii) "while identifying such issues, to place emphasis on areas where coordination and cooperation at the intergovernmental and inter-agency levels should be enhanced" (UNDOALOS 2004, 2). Although the first ICP meeting was held in 2000, it was during the third (2002), fourth (2003) and fifth (2004) meetings that issues pertaining to the conservation of marine biodiversity in areas beyond national jurisdiction came to the fore (United Nations General Assembly 2003, 3).

At the 2002 meeting, the ICP recommended that the UNGA call for States to urgently consider means of improving management of risks to vulnerable deep sea habitats and deep ocean biodiversity (Deep Sea Conservation Coalition 2004, 1). The fourth report of the ICP welcomed the commitments and temporal goals set out during WSSD; emphasised the need for "an integrated, interdisciplinary, intersectoral and ecosystem-based approach to management"; and acknowledged the goals and objectives of Chapter 17 of Agenda 21, the 1982 LOSC, and the Johannesburg Plan of Implementation (United Nations General Assembly 2003, 6).

Amongst the litany of ICP proposals with relevance to the creation of high seas marine protected areas presented to the UNGA during 2003 were:

- Urgent consideration of the means of integrating and improving management of risks to the biodiversity of seamounts, cold water coral reefs and "certain other underwater features";
- Relevant international bodies to consider more effective methods to tackle threats and risks to vulnerable and threatened marine ecosystems and biodiversity in the high seas;
- Exploring how existing oceans-related treaties and instruments could be used to protect high seas biodiversity, with particular emphasis on the 1982 LOSC through a mechanism such as an implementing agreement;

- Identification of those marine ecosystems requiring priority attention; and
- Reaffirmation of:

> ...the efforts of States to develop and facilitate the use of diverse approaches and tools for conserving and managing vulnerable marine ecosystems, including the establishment of marine protected areas, consistent with international law and based on the best scientific information available, and the development of representative networks of such marine protected areas by 2012. (UN General Assembly 2003, 7-8).

Discussions during the 2004 (fifth) meeting of the ICP focused on the need to protect vulnerable and fragile marine ecosystems such as seamounts and hydrothermal vents together with calls for stakeholders to be involved in raising awareness about the vulnerability of ocean geomorphic features. The idea of creating a fresh regime to deal with the protection of ecosystems was suggested, although some delegates were of the view that existing regimes, once effectively implemented, would have the capacity to provide the level of protection necessary to protect these underwater features. Some delegates stressed the need for a holistic rather than individual site approach to safeguard vulnerable marine ecosystems. Many participants identified "unsustainable fishing activities" as a major risk to marine biodiversity. Once again, the LOSC was hailed as the primary legal framework for protection of habitat and resources both within and beyond national jurisdiction together with a number of complementary, supplementary or alternative formal and informal instruments were also included in the assessment of legal mechanisms (UN General Assembly 2003, 19, 27-28).

The management tools identified and discussed at the 2004 ICP meeting included: (i) implementation of an integrated marine and coastal area management plan; (ii) establishment of marine protected areas; (iii) application of the ecosystem approach; and (iv) application of the precautionary approach. In relation to high seas MPAs, delegates emphasised the need for scientific evidence to justify their establishment; that they be assessed on a case-by-case basis; and that they be consistent with international law in order and therefore 'enforceable' (UN General Assembly 2003, 29-30).

Also on the agenda of the 2004 meeting were: "...new sustainable uses of the oceans, including the conservation and management of the biological diversity of the seabed in areas beyond national jurisdiction", and the exercise of more effective conservation and management of marine biodiversity of the high seas both within and beyond the walls of the UN (UN General Assembly 2004, 2). Risks to geomorphic features of the Area – primarily seamounts, coldwater corals, and hydrothermal vents - had been documented in a number of preceding UNGA texts, and several delegates were pressing for risk management measures to be implemented as quickly as possible in an effort to turn words into action (UN General Assembly 2004, 2).

The ICP presented a number of potential oceans biodiversity conservation mechanisms for areas beyond national jurisdiction to the UNGA, including a moratorium on destructive practices by fishing vessels on the high seas. It also recommended the UNGA: (i) encourage collaborative marine research efforts with the aim of increasing understanding of marine habitats and resources beyond national jurisdiction and in accordance with the LOSC; (ii) explore the opportunities and risks associated with gas hydrate extraction;(iii) urge regional fisheries management organisations (RFMOs) to regulate deep sea trawling fisheries; and (iv) for RFMOs to extend their mandate to cover such activities if they did not have the competency to impose conservation regulations in accordance with international law (UN General Assembly 2004, 3-4).

The proposal for an interim ban on deep sea bottom trawling in the high seas was met with a mixture of support, sympathy and strong opposition. A number of delegates were of the view that a moratorium would place "unnecessary restrictions on the interests of the fishing industry", thereby counteracting States' rights and freedoms on the high seas. They also called for the accumulation of more scientific data to justify the interim ban. Advocates and supporters of the moratorium suggested a "region-by-region" or "area-by-area" ban in preference to global prohibition, adding that such bans could be lifted once "efficient conservation and management measures" were in place. Despite vigorous debate, delegates were unable to recommend that the UNGA adopt a moratorium on bottom trawling on the high seas because of a lack of consensus on the issue (UN General Assembly 2004, 19, 21). In December 2006, however, the UNGA adopted Resolution 61/105 with the intent of controlling bottom fishing of all kinds (Scrivner and Baxter 2009).

During the fifth ICP meeting, discussion moved to that of marine biodiversity conservation in areas beyond national jurisdiction and the role of MPAs as protective mechanisms. A number of delegates cited LOSC articles 192 (the obligation to protect and preserve the marine environment) and 194(5) (the obligation to protect and preserve rare or fragile ecosystems) as justifying the creation of high seas MPAs. Others took the opportunity to remind their colleagues of the obligation to cooperate in the conservation and sustainable use of biological diversity in areas beyond national jurisdiction as expressed in article 5 of the CBD. It was suggested by non-government organisations that the international community consider alternative ocean governance options such as the adoption of an international instrument devised to provide a mechanism for the establishment and regulation of a high seas MPA system, and suggested this mechanism be modelled on the Mediterranean Protocol Concerning Specially Protected Areas and Biological Diversity.

The seventh meeting of the ICP, held in June 2006, saw participants agreeing to a number of 'elements' relating to ecosystem approaches and oceans and these were proposed for consideration at the 61st session of the UNGA. These elements focused on ecosystem management and science, and discussion again turned to protection of vulnerable marine ecosystems in areas beyond national jurisdiction. An unnamed non-governmental organization proposed development of a network of MPAs covering between 30 and 50 per cent of the high seas as a way of enabling "development of baselines against which to measure the effectiveness of ecosystem approaches implemented outside the MPAs" (UNGA A/61/156, 2006 paragraph 99, 24). Again, the prospect of a LOSC Implementing Agreement addressing protection and protection of the marine environment in areas beyond national jurisdiction was discussed although opinions diverged on the need for such an agreement. As had occurred at previous meetings of the ICP, NGOs were the key advocates of the implementing agreement proposal, urging delegates to consider the intrinsic value of oceans biodiversity (UN General Assembly A/61/156, 2006 paragraph 96).

The United Nations General Assembly: 59th Session on Oceans and Law of the Sea – Report of the Secretary General (2004)

Amongst the many items tabled at the 59th Session under the general agenda item of "Oceans and Law of the Sea", was acknowledgement and reaffirmation of paragraph 32 (c) of the WSSD Johannesburg Plan of Implementation calling for the establishment of a representative system of MPAs by 2012. On the basis of recommendations adopted by the ICP, the Assembly restated the need for the international community to address marine biodiversity issues in areas beyond national jurisdiction, and in particular to consider options for improving and integrating management of risks to vulnerable geomorphic features of the ocean floor (United Nations General Assembly 59th Session 2004a, paragraph 231). Likewise in paragraph 163 of the 59th Session[66], the Assembly echoed the sentiments of Resolution 58/240 by calling for:

> [R]elevant global and regional bodies, in accordance with their mandates, to investigate urgently how to better address, on a scientific basis, including the application of precaution, the threats and risks to vulnerable and threatened marine ecosystems and biodiversity in areas beyond national jurisdiction; how existing treaties and other relevant instruments can be used in this process consistent with international law, in particular with UNCLOS [sic], and with the principles of an integrated ecosystem-based approach to management, including the identification of those marine ecosystem types that warrant priority attention; and to explore a range of potential approaches and tools for their protection and management (United Nations General Assembly 59th Session Addendum 1, 2004 paragraph 163).

The UNGA also noted[67] the Scientists' Statement on Protecting the World's Deep-Sea Coral and Sponge Ecosystems, an official statement signed by 1,136 marine scientists and released simultaneously in Seattle, Kuala Lumpur, Santiago and Madrid in February 2004. Instigated by the Marine Conservation Biology Institute (a US-based research institution), the Statement outlined the concerns of marine scientists and conservation biologists regarding: "...unprecedented damage to deep sea coral and sponge ecosystems" (Marine Conservation Biology Institute 2004). It identified bottom trawling as the primary cause of degradation and as such, the "greatest human threat" to these fragile ecosystems. The signatories urged nation-states to ban bottom trawling

[66] United Nations General Assembly 59th Session 2004 Addendum 1
[67] See paragraph 238 of the Meeting Record for the 59th Session

within their jurisdictions and for the appropriate international bodies, including the United Nations General Assembly, to impose an immediate interim ban on this destructive fishing practice in oceans beyond national jurisdiction (Marine Conservation Biology Institute 2004).

The value of articles in the 1982 LOSC and the CBD that address specifically the conservation and management of high seas biodiversity were articulated in the UNGA 59th Session Report, as were the litany of challenges. Paragraph 266 of the Report, for example, acknowledges the damage inflicted by bottom trawling on seamounts and deepwater corals. The real and potential effects of seabed mining on hydrothermal vent systems and seamounts were also addressed although the Assembly also added that mining issues remained the mandate of the International Seabed Authority rather than the UNGA. The "legal lacuna" identified in regard to bioprospecting in the marine environment beyond national jurisdiction was referred to fleetingly, with the LOSC and the CBD identified as potential mechanisms for filling any legal gaps, at least in terms of general or guiding principles for action (UN General Assembly 2004a, paragraph 266).

Addendum 1 of the 59th session of the General Assembly identifies the management tools, mechanisms and options for the conservation of high seas biodiversity, including marine protected areas and voluntary codes of conduct for resource appropriators and scientific researchers. Some of these tools and mechanisms are reflected in the mandates of arrangements, authorities, and organisations such as the UNEP Regional Seas Programme; the Commission for the Protection of the Marine Environment of the North-East Atlantic; the Antarctic Treaty system; the Arctic Council; the International Maritime Organisation, and regional fisheries management organisations.[68] Paragraph 299 of the Report reiterates concerns expressed during previous sessions of the General Assembly, in particular the damage to ocean floor geomorphic features by bottom

[68] United Nations General Assembly 59th Session Addendum 1, 2004, paragraphs 279, 287, 290, 291, and 293

trawling, with emphasis on the impact this practice has on seamount and coldwater coral biodiversity and habitats.

A special session of the UN 59th General Assembly was held in November 2004 to mark the tenth anniversary of the entry into force of the LOSC. Greenpeace, speaking on behalf of the Deep Sea Conservation Coalition (DSCC), addressed the UNGA for the first time, imploring world governments to safeguard the future of the oceans by implementing an interim ban on bottom trawling on the high seas (Deep Sea Conservation Coalition 2004). Despite intense lobbying by NGOs and delegates from Costa Rica, Chile, Palau, Norway and New Zealand, the moratorium proposal was opposed by the EU (at the instigation of Spain) and Iceland, whose delegates proposed the use of more moderate measures than that of a moratorium. The UNGA consequently softened its language and the resulting resolution (A/RES/59/25), adopted without a vote, was expressed in significantly weaker terms than that proposed initially (Leipold, Pastor, Norse and Cárdenas 2004). While the end result reiterated delegates' concerns regarding the destructive practice of bottom trawling, it went only so far as to request that nation states and regional fisheries management organisations take responsibility and impose regulations on a case-by-case basis "until such time as appropriate conservation and management measures have been adopted in accordance with international law" (UN General Assembly 2004b, paragraph 66; Leipold, Pastor, Norse and Cárdenas 2004).

The Assembly also announced a decision (see paragraph 73 of UNGA resolution 59/24) to establish "an Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction" (UN General Assembly 2004b, paragraph 73). The DSCC, disappointed at the UNGA's dilution of its moratorium proposal, expressed concern that the destruction of deep sea habitats and organisms would continue unabated while the Ad Hoc Open-ended Informal Working Group conducted its research into these issues (Deep Sea Conservation Coalition 2004).

Nevertheless, proponents for the interim ban saw cause for optimism. A number of nations, namely New Zealand, Costa Rica and Norway, had demonstrated commitment to the conservation of vulnerable deep sea habitats by protecting some of those at risk in waters within their own jurisdictions (Deep Sea Conservation Coalition 2004). The IUCN vowed to continue its campaign to have a moratorium in place that bans bottom trawling on the high seas. Indeed the IUCN's response was to recommend during its Third World Congress[69] (November 2004) that the UNGA, in its 60th session, adopt a resolution imposing an interim ban on high seas bottom trawling in areas not covered by RFMOs or by any other management arrangements possessing the legal competence to manage bottom fisheries. The IUCN also recommended that this interim ban be extended to those areas covered by RFMOs at the UNGA 61st session held in 2005 (IUCN 2004 (c)), although this proposal ultimately failed to garner the necessary support by the UNGA at its 60th session and therefore did not proceed.

United Nations General Assembly Ad Hoc Open-Ended Informal Working Group

As noted earlier, the UNGA Ad Hoc Open-Ended Informal Working Group was formed to examine and discuss issues relating to the conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction. The Group's inaugural meeting was held in New York in February 2006. Its mandate included examining and analysing scientific, technical, economic, legal, environmental, and social aspects relating to protection of marine biodiversity in areas beyond national jurisdiction. Armed with the relevant knowledge, the Group then explored possible options and mechanisms for promoting international cooperation and coordination that might contribute to effective conservation of high seas biodiversity, including expanding the scope of the CBD to areas beyond national jurisdiction (Morgera 2007, 6). The meeting provided an unprecedented opportunity to address sectoral issues relating to marine biodiversity in the high seas and Area in a frank exchange of views between national delegates that resulted in a 'non-negotiated outcome' (Morgera 2007, 6).

[69] The World Congress recommendations are made with the full force of the organisation's membership which consists of 81 states, 114 government agencies and more than 800 NGOs, unlike the recommendations made during the 2003 World Parks Congress which reflected the views of the marine theme working group, not the IUCNs full membership (Anon. 2004/2005, 5).

The European Union (EU), Australia, New Zealand and Canada reiterated the high priority each had placed on achieving the WSSD 2012 target, which in their view, included the creation of high seas marine protected areas. They also acknowledged the primacy of the UNGA and identified it as the appropriate forum for issues pertaining to the protection of high seas biodiversity. While the group of developing countries (G77 and China) were of the view that high seas MPAs were not a priority, they also agreed that matters pertaining to marine biodiversity in areas beyond national jurisdiction needed to be discussed within the framework of the UNGA. Mexico insisted the competency of the CBD and FAO extended only to scientific matters and that the UNGA was the appropriate forum for ensuring cooperation, coordination, and identification of relevant criteria for creating high seas MPAs. Japan, Norway, Iceland and the Republic of Korea opposed the role of the CBD as a forum for high seas MPA negotiations, arguing that the FAO and regional fisheries management organisations (RFMOs) were the most appropriate bodies. In contrast, the US believed the FAO and the IMO to be the most appropriate. Argentina opposed the concept of affording RFMOs a mandate for establishing high seas MPAs and Australia shared this view, adding that RFMOs could not "be expected to establish protected areas for purposes other than fisheries conservation" (Morgera 2007, 7).

Many delegates expressed the need for a universal understanding and common definition of the ecosystem approach and for yet more work to be undertaken on the concept of high seas MPAs (Report of the Ad Hoc Open-ended Informal Working Group 2006, para.44). It was generally agreed that improving the level of implementation of existing instruments was a priority in addressing the conservation and sustainable use of high seas biodiversity. Some delegates were of the view that existing instruments provide "an adequate legal framework" for addressing the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction (Report of the Ad Hoc Open-ended Informal Working Group 2006, para.51). Delegates also discussed the option of a high seas MPA implementing agreement to the LOSC, with some of the opinion that it would create the:

> ...necessary legal framework for enhancing cooperation for the integrated conservation and management of marine biological diversity beyond areas of

> national jurisdiction, including through the establishment of networks of marine protected areas based on scientific evidence.” (Report of the Ad Hoc Open-ended Informal Working Group 2006, para.55)

Others, however, were of the view that the adoption of any new instrument was not going to help stem the loss of marine biodiversity. Some disagreed fundamentally with the need to adopt any new instrument, warning of the complex and demanding nature of negotiating a new legal instrument, and preferring to see instead efforts to improve the implementation of, and adherence to, existing arrangements (Report of the Ad Hoc Open-ended Informal Working Group 2006, paragraph 55). Representatives of environmental NGOs, however, pressed for development of a new oceans governance regime for areas beyond national jurisdiction and argued for incorporation of a litany of principles, approaches and paradigms, including the ecosystem approach, the precautionary principle, sustainability, equity, adaptability and flexibility. They also reiterated their wish for a global network of marine protected areas, and expressed overwhelming support for a new implementing agreement to the LOSC to address oceans governance in areas beyond national jurisdiction (Report of the Ad Hoc Open-ended Informal Working Group 2006, para.58).

Prior to the 2006 ICP meeting, Greenpeace had released a document titled “Black Holes in Deep Ocean Space: Closing the legal voids in high seas biodiversity protection” (2005). It listed “five principle objectives” for a revised LOSC regime:

- Provide a clear mandate and legal duty to protect biodiversity on the high seas, based on ecosystem management and the precautionary principle;
- Promote coordination and harmonisation between relevant international and regional instruments;
- Clarify the rules governing access to, and the sharing of benefits derived from high seas genetic resources;
- Provide adequate implementation tools, including a mandate to establish and manage marine reserves in areas beyond the limits of national jurisdiction; and
- Establish an effective centralised monitoring, control and surveillance mechanism for human activities on the high seas (Greenpeace 2005).

How this last principle might be funded and administered was not addressed by Greenpeace in its publication.

The Group agreed that the UNGA has primacy in addressing ocean matters within and beyond national jurisdiction. The complementary role of other organisations, processes and agreements such as the FAO, CBD, IMO and regional seas conventions, and their contributions to an integrated consideration of marine biodiversity issues with the UNGA was also recognised and noted (Morgera 2007, 7). The Co-chair’s summary noted that: “...area-based management tools, such as marine protected areas, are widely accepted and further elaboration of criteria for the identification, establishment and management of marine protected areas is required” (Morgera 2007,7). While high seas marine protected areas were discussed, there was no reference to them in the official meeting report (Morgera 2007, 7). The meeting prepared the way for further work, and “its non-negotiated outcome proved very influential in the ensuing negotiations in the framework of the CBD” (Morgera 2007, 7).

The Working Group reconvened in New York in April-May 2008 and heard a number of presentations on advances in biogeographic classification for areas beyond national jurisdiction and how the classification system could support decision making in spatial planning and other conservation measures such as marine protected areas (Ad Hoc Open-ended Informal Working Group 2008). The Group noted progress made on the impact of unsustainable fishing practices (primarily bottom trawling) through UNGA resolution 61/105, and reiterated the need to achieve the goals set by the international community, including those established at the 2002 WSSD and the 2005 WPC (UNGA A/63/79 paras 7 & 8). Concerns were raised, however, over the impacts of new and emerging technologies including geo-engineering ventures involving carbon sequestration and large-scale ocean iron fertilisation (UN General Assembly A/63/79 para. 14).

In discussions addressing coordination and cooperation among stakeholders for the conservation and management of marine biological diversity in areas beyond national jurisdiction, the same fractures over particular issues remained. Again, some delegates supported the need for a new mechanism to fill the legal 'gap' in order to accelerate progress toward establishment of a global representative system of MPAs by 2012, while others saw no need for new mechanisms, preferring instead that resources focus on improving the efficacy of existing instruments (UNGA A/63/79 para. 27). Support was expressed for the establishment of pilot multi-purpose MPAs in the high seas and Area, while others emphasised the importance of recognising regional differences and the need to develop area-based management tools on a case-by-case basis. The view was also expressed that MPAs need to have "clearly delineated impact areas and a strong causal link between the management measures and the harm being addressed" (UN General Assembly A/63/79 paras. 30 & 31).

Convention on Biological Diversity

Overview

As noted earlier, one of the many outcomes of the 1992 Earth Summit was the CBD which entered into force on 29 December 1993. Comprising 193 Parties, the Convention's overarching goals are to promote the conservation of biological diversity; sustainable use of resources; and the just and equitable sharing of benefits gained from the use of genetic materials (International Institute for Sustainable Development 2003a).

The governing body of the CBD is its Conference of Parties (COP) which meets regularly to address issues pertaining to the Convention's overarching goals. The competency of the CBD extends only to the limits of national jurisdiction. Beyond those limits, Parties to the Convention are obliged only to *cooperate* in the conservation and sustainable use of biological diversity, and to ensure that their activities and actions do not affect biological diversity in areas beyond the limits of national jurisdiction (Articles 4 and 5, emphasis added) (Morgera 2007, 5).

Article 22 (1) of the CBD addresses the relationship of the Convention with other international conventions, and states that:

> The provisions of this Convention shall not affect the rights and obligations of any Contracting Party deriving from any existing international agreement, except where the exercise of those rights and obligations would cause a serious damage or threat to biological diversity.

Although the competency of the Convention does not extend to the components of biodiversity beyond national jurisdiction *per se*, there are those who, in arguing in favour of the competence of the CBD in such areas, interpret the exception in Article 22 (1) as supporting the primacy of the CBD over the LOSC when serious damage to biological diversity arises as result of the exercising of rights and obligations under the LOSC (Morgera 2007, 5). The common interpretation is that the LOSC provides the broad legal framework for all activities on or in the ocean, while the CBD has limited legitimacy in relation to the protection and sustainable use of marine biodiversity in areas beyond national jurisdiction (Morgera 2007, 5).

A multi-year programme of work for implementation of mechanisms for addressing the conservation and sustainable use of marine and coastal biodiversity at national, regional and global levels was confirmed in decision IV/5, made during the fourth meeting of the COP in 1998. The programme of work was premised on the usual eco-ethical principles – the precautionary approach; the ecosystem approach; the import of science; and respect and acknowledgement of indigenous and localised knowledge - and divided into five programme areas (UNEP/CBD/SBSTTA/8/9, 6):

- (i) integrated marine and coastal management;
- (ii) sustainable use of marine and coastal living resources;
- (iii) marine and coastal protected areas
- (iv) mariculture; and
- (v) alien species and genotypes

The Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity, and Ad Hoc Technical Expert Group on Marine and Coastal Protected Areas

One of the first COP decisions, made in accordance with Convention Article 25, was to create a body of experts who would convene on a regular basis and provide advice to the Parties to inform the latter's decisions on the implementation of the Convention. Established in 1999, the panel is known as the Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity (SBSTTA).

Another body established during the fourth COP and articulated in Decision IV/5 is that of the Ad Hoc Technical Expert Group on Marine and Coastal Protected Areas (AHTEG). Its purpose is to: "assist SBSTTA in its deliberations on the issue of marine and coastal protected areas" (UNEP/CBD/SBSTTA /8/9/Add.1, 1). The mandate of the AHTEG (UNEP/CBD/SBSTTA /8/9/Add.1, 1) is to:

- Identify pilot research and monitoring projects with the aim of assessing the value and effects of marine and coastal protected areas on sustainable use of resources;
- Identify linkages between marine and coastal protected areas and sustainable use of marine and coastal biodiversity; and
- Prepare recommendations on types of research to be carried out in order to understand the effects of marine and coastal protected areas on population size and dynamics, subject to national legislation.

Although marine and coastal biodiversity issues had been addressed previously by the SBSTTA, it was not until the eighth and ninth meetings, both held during 2003, that the conservation of biodiversity in areas *beyond* national jurisdiction came to the fore. The AHTEG Summary Report presented at the eighth and ninth meetings of the SBSTTA acknowledged the paucity of MPA networks at regional and global levels and the crucial role such protection measures could play in any integrated marine and coastal area management strategy (UNEP/CBD/SBSTTA /8/9/Add.1, 10). In the true spirit of CBD's fundamental principle – biological sustainability - the Ad Hoc Group agreed that the goal for the programme of work under the CBD relating to marine and coastal protected areas should be:

> The establishment and maintenance in perpetuity of an effectively managed, *ecologically representative global system of marine and coastal protected area networks*, where human activities are managed to maintain the structure and functioning of the full range of marine and coastal ecosystems, in order to provide benefits to both present and future generations (UNEP/CBD/SBSTTA /8/9/Add.1, 4, emphasis added).

In order to expedite this goal, the AHTEG adopted the WSSD target date of 2012 for the establishment of "a global representative system of marine and coastal protected area networks" and agreed to develop a strategy and progress indicators to meet the SBSTTA goal within the WSSD time frame (UNEP/CBD/SBSTTA /8/9/Add.1, 4). In addressing MPAs in areas beyond national jurisdiction, the Ad Hoc Group noted jurisdictional uncertainties and encouraged communication between relevant international organisations to stem anthropogenic impacts on high seas biodiversity. The AHTEG emphasised the urgency of establishing a global system of ecologically representative MPA networks despite the "paucity of facts to inform appropriate decisions within the Convention" (UNEP/CBD/SBSTTA /8/9/Add.1: 5, 11,14). The AHTEG also encouraged relevant governments, parties and organisations "to provide active financial, technical and other support" for the establishment of such networks, and requested parties to identify and remove those barriers which stand in the way of MPA creation (UNEP/CBD/SBSTTA /8/9/Add.1, 5).

It is worth noting that while the AHTEG recognised the dearth of high seas MPAs and the urgent need for their creation, the assessment, monitoring and research priorities and potential pilot projects itemised in their Summary Report deal explicitly with work related to areas *within* national jurisdictions (UNEP/CBD/SBSTTA /8/9/Add.1, 14). Also somewhat confusing is the diagram titled "Elements of the Marine and Coastal Biodiversity Management Framework" (UNEP/CBD/SBSTTA /8/9/Add.1, 18) which is a sketch of a stretch of coastline with the appropriate geopolitical demarcations, but with coastal and transboundary MPAs only; it does not include discrete high seas MPAs. Granted, the CBD is limited in terms of jurisdictional scope, extending only as far as the

Exclusive Economic Zone (EEZ) or territorial sea of nation-states as defined in Article 4. However, part (b) of Article 4 makes the Contracting Parties to the Convention responsible for the actions and activities of their citizens, irrespective of geopolitical boundaries in cases where their activities have an adverse effect on biological diversity even though the CBD does not itself extend directly to the conservation of biological diversity in supra-jurisdictional oceans. The CBD also appears to have adopted a leadership role in relation to marine protected areas in oceans beyond national jurisdiction and seems determined to be afforded some authority in this regard, so the oversight is rather perplexing.

Article 5 of the CBD applies to the actions and activities of Parties on the high seas. It states that:

> ... each Contracting Party shall, as far as possible and appropriate, cooperate with other Contracting Parties, either directly or through competent international organisations in respect of areas beyond national jurisdiction or control, for the conservation and sustainable use of biological diversity" (Vierros and Ogolla 2003, 2).

As noted earlier, Article 5 is interpreted by some as an extension of the competency of the Convention to include specific management regimes such as a network of high seas MPAs. When the central principles of the CBD - the ecosystem approach, the precautionary principle, and the import of scientific knowledge - are factored in with Articles 4 and 5, it could be interpreted as affording the CBD a greater role in the establishment of a global representative system of MPA networks, especially in light of the Convention's emphasis on ecosystems rather than geopolitical boundaries. Nevertheless the primacy of the LOSC in defining maritime boundaries remains, however, the CBD and the 1982 LOSC are considered by the high seas epistemic community to be the primary global environmental regimes for shaping the course and evolution of high seas MPAs.

The eighth SBSTTA meeting was attended by 460 participants representing 121 governments and UN agencies, together with indigenous, academic, non-governmental and governmental organisation representatives (International Institute for Sustainable

Development (a) 2004, 1). Armed with the AHTEG report on MPAs, participants reviewed the marine and coastal biodiversity programme of work and discussed a number of issues pertaining to marine protection. A number of calls, proposals and responses were put forward by participants that are noteworthy because they provide insights into the level of support and opposition around the concept of MPA networks (International Institute for Sustainable Development 2003a, 8):

- Several countries supported the establishment of MPAs both within and beyond national jurisdiction;
- France requested an extensive study on the impact that MPAs have on fisheries activities and economic sustainability;
- Japan opposed any MPAs in areas beyond national jurisdiction;
- Argentina opposed any discussion on the relationship of MPAs with the 1982 LOSC;
- Australia declared support for the WSSD 2012 target and acknowledged the depth and breadth of management practices that fall beneath the rubric of 'MPA';
- The US stated that MPAs can only be successful when based on sound science, are enforceable, "activity-oriented" and consistent with international law;
- Norway asserted that the creation of MPAs must be ecosystem-specific and conducted on a regional basis;
- Germany called for more work to be done on the legal aspects of MPAs;
- WWF suggested a targeted monitoring mechanism on the establishment of MPA networks and individual sites;
- Turkey proposed that work on specific MPAs be subject to the scrutiny and multilateral consent of all countries in the region;
- Australia, Jamaica, and the European Community opposed a proposal by Brazil to restrict MPA networks to areas within national jurisdiction;

- Iceland proposed that the IUCN protected area classification and management categories be the foundations for building a global representative system of MPA networks. This proposal was met with some opposition;
- The UK expressed disappointment that the IUCN categories were not paid the attention they deserved; and
- Delegates agreed that jurisdiction in the high seas is provided for by international instruments such as the LOSC and regional agreements.

After lively debate, the SBSTTA articulated a number of final recommendations on marine and coastal protected areas in its eighth report to the CBD's Conference of Parties. In the context of MPA goals, the recommendations declared that (International Institute for Sustainable Development 2003a, 9):

- Establishment of MPAs must be in accordance with international law in areas beyond national jurisdiction, and consistent with domestic legislation when located within the EEZ or territorial seas;
- In order to meet the WSSD 2012 target a clear strategy must be developed; and
- That the goal of the CBD's work should be the establishment and maintenance of MPAs that contribute to a permanent representative global network of MPAs including a range of levels of protection. [70]

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The SBSTTA also called for international collaborative efforts to distinguish those mechanisms instrumental to the establishment of high seas MPAs and identified the CBD as one amongst a number of suitable organisations for involvement in such a project (Vierros and Ogolla 2003, 5-6). The Conference of Parties to the CBD has, over the past few years, emphasised the need for more effective implementation of measures

[70] According to the SBSTTA, a 'global network' means a social network, one which: "...provides for the connections between Parties, with the collaboration of others, for the exchange of ideas and experiences, scientific and technical cooperation, capacity building and cooperative action that mutually support national and regional systems of protected areas which collectively contribute to the achievement of the programme of work. This network has no authority or mandate over national or regional systems." ("Decision VII/5 Marine and Coastal Biodiversity: Review of the programme of work on marine and coastal biodiversity", 2004, 35-36).

which are guided by its key principles, together with the goal of achieving "a significant reduction in the current rate of biodiversity loss at the global, regional and local level" by 2010, a target which was endorsed by the Hague Ministerial Declaration of 2002 and echoed in the WSSD Johannesburg Plan of Implementation of the same year. As noted by the WWF, approximately two thirds of the world's oceans are classified as high seas, therefore if the CBD is aiming to stem the loss of biodiversity by 2010, it is prudent that it play an active part in the conservation and sustainable use of high seas biological diversity (Vierros and Ogolla 2003, 7).

The ninth SBSTTA meeting, held in 2003, also boasted an impressive attendance record. Approximately 600 participants representing 119 governments and relevant UN agencies, together with representatives from academia, industry, and governmental and non-governmental organisations attended the November 2003 meeting where protected areas were again one of the main themes for discussion (International Institute for Sustainable Development (b) 2004, 1). Among the many documents proffered during the meeting was the "Integration of Outcome-oriented Targets into the Programmes of Work of the Convention"[71] with an addendum addressing the applicability of these targets for the implementation of the marine and coastal biodiversity programme of work. The Outcome-oriented Targets comprised a number of goals accompanied by specific targets, as well as rationales and a litany of indicators and/or means of verification designed to achieve them. The latter are consistent with the WSSD Johannesburg Plan of Implementation and the 2010 biodiversity target set by the CBD. Those with relevance to high seas MPAs are as follows:

- **Goal 1:** Halt the loss of ecosystems, habitats and biomes
  Target 1: Provide effective protection for a minimum of 10% of each habitat type globally, and establish MPAs in areas beyond national jurisdiction as a step toward a longer term target of 20-30% of each habitat type in effectively managed marine and coastal protected areas.

[71] The full title of this document is: "Integration of the Outcome-oriented Targets into the Programmes of Work of the Convention, Taking into Account the 2010 Biodiversity Target, the Global Strategy for Plant Conservation, and Relevant Targets set by the World Summit on Sustainable Development: Addendum – Outcome-oriented targets for the implementation of the elaborated programme of work on marine and coastal biodiversity".

Target 2: Effective protection, monitoring and enforcement for a minimum of 30 per cent of tropical and cold water coral reefs and seamounts and other vulnerable marine and coastal ecosystems to be provided by 2010 (UNEP/CBD/SBSTTA/9/14/Add.3, 5-6).

Relevance to high seas MPAs: A minimum of ten scientifically significant and globally representative highly protected MPAs should be implemented by 2010. The target number of five high seas MPAs by 2008 was contained in recommendation 5.23 of the 2003 WPC and the target of ten high seas MPAs by 2010 target should be interpreted in this context.

- **Goal 2:** Halt loss of species diversity

  Target 3: Establish and implement effective programmes to conserve *in situ* 80 per cent of the known globally threatened and endangered marine species listed in 2002.

  Relevance to high seas MPAs: The conservation of unknown species can be facilitated through the use of precautionary tools such as networks of high protected MPAs[72] (UNEP/CBD/SBSTTA/9/14/Add.3, 7).

- **Goal 3:** Halt loss of genetic biodiversity.

  Target 4: Measure and reduce significantly the loss of marine and coastal biodiversity by 2010 (UNEP/CBD/SBSTTA/9/14/Add.3, 8).

  Relevance to high seas: The genetic resources found in deep ocean habitats such as hydrothermal vents, cold seeps and abyssal plains have attracted much interest from biopharmaceutical and biotechnology companies. Without proven benign methods of extraction, the genetic biodiversity of such deep ocean habitats may be jeopardised by extractive activities.

- **Goal 5:** Stop unsustainable use, including unsustainable fishing and other extractive activities.

  Target 6: Ensure by 2010 that unsustainable and destructive fishing practices are eliminated.

[72] It is difficult to envisage how a network of MPAs could assist in the protection of unknown species – if the species have not yet been discovered, how would one know where to place the MPAs in order to protect them?

Relevance to high seas: High impact fishing practices, such as bottom trawling, cause damage to sensitive habitats such as coldwater corals and seamounts (UNEP/CBD/SBSTTA/9/14/Add.3, 10).

- **Goal 7**: Maintain capacity of ecosystems to deliver goods and services.
  Target 10: Implement the ecosystem approach for management of marine and coastal living resources (UNEP/CBD/SBSTTA/9/14/Add.3, 13).
  Relevance to high seas: Although there is a paucity of scientific data on the ecosystem services and goods provided by deep ocean habitats and organisms, there is no doubt that they play a vital role in the complex adaptive system of which they are a part.

A Working Group was convened to discuss issues relating to protected areas, with a particular focus on the outcome-oriented targets identified as necessary for the effective implementation of the work programme on marine and coastal biodiversity. Again, the views of delegates open a window on oceans governance issues in areas beyond national jurisdiction (International Institute for Sustainable Development 2003b, 4, 12):

- India, Portugal and the US called for duplication of work to be avoided;
- While some delegates reiterated calls for the establishment of high seas MPAs, Turkey expressed concern about exclusive references to the LOSC, (as Argentina had done during the eighth meeting);
- Following calls for prompt funding, Norway, Cuba, Indonesia, The Philippines and Argentina expressed their concerns about the ambitious nature of the work programme and the difficulties that developing countries face in meeting timelines;
- Brazil stated that the bulk of proposed goals and targets fall outside the ambit of the CBD;
- Switzerland expressed concerns about the excessive number of goals, targets and indicators;
- A number of delegates also voiced their views on the length and complexity of the work programme, and its lack of focus on ecological networks;

- Jordan and Liberia proposed that the socio-economic impacts of MPAs be considered;
- The European Community, together with a number of like-minded parties, stated its belief that the primary objective of the CBD should be the development of a global system of representative and effectively managed ecological network of marine protected areas on a national and regional basis by 2012; and
- The environmental NGO, Natural Resources Defense Council, proposed an interim ban on bottom trawling on the high seas until a legally binding regime comes into force.

In the closing stages of the meeting, delegates in the protected area Working Group agreed to reject any exclusive reference to the 1982 LOSC following concerns from Turkey and a number of other parties. Three Parties reached agreement on the establishment of high seas MPAs after discussion about options for cooperation in areas beyond national jurisdiction. Delegates adopted the draft conference room paper in the form of a partially bracketed work programme with minimal amendments (International Institute for Sustainable Development 2003b, 4). The final recommendations of the Protected Areas Working Group to the Closing Plenary session of the ninth SBSTTA meeting were (International Institute for Sustainable Development 2003b, 4-5):

- That the Conference of Parties (COP) to the CBD "confirm that efforts to establish and maintain systems of protected areas are essential for achieving the 2010 target";
- That the COP invite Parties to develop national and regional targets and incorporate them into appropriate initiatives;
- That the COP stress the need for capacity building to bolster implementation of protected areas; and
- That the COP consider options so that the concept of ecological networks can be considered.

No recommendations on the integration of outcome-oriented targets into the programme of work on marine and coastal biodiversity were adopted and it was agreed that the targets would be further refined by the SBSTTA at future meetings. The draft document on outcome-oriented targets presented at the tenth meeting in Bangkok, February 2005 reflects the changes made following some of the concerns and sentiments expressed by delegates during the eighth and ninth SBSTTA meetings. Of particular interest, apart from subtle changes in wording throughout the revised document, is the disappearance of the 20-30 per cent figure for “effective conservation”[73] of marine and coastal ecosystems. This figure had been identified as a longer-term target in the original document (see Goal 1: Target 1 of the Outcome-oriented Targets itemised above), however, the refined version states that:

> *The 10 per cent figure* [original emphasis] in this target is lower than the optimum 20-30 per cent figure for sustainable use of living resources quoted in most research findings and should therefore be viewed as an intermediate, policy- relevant target while the needs for long-term protection would be determined in the context of adaptive management, taking into account the status and unique characteristics of each ecological region (UNEP/CBD/SBSTTA/10/8/Add.1, 4).

The ‘refined’ figures in the first target of Goal 1 and jettisoning of the ‘optimum’ figure of 20-30 per cent of each habitat type reflects the preferences expressed by some SBSTTA delegates for a more pragmatic approach such as case-by-case or habitat-by-habitat assessment in order to identify those marine and coastal areas most in need of effective conservation of biological diversity.

In a section of the Addendum addressing the status of, and threats to protected areas (both terrestrial and marine), the delegates recommended the COP recognise that even though there had been an increase in the number of protected area systems, they were not representative of the planet’s ecosystems. Delegates also recommended that the COP acknowledge the many existing challenges and barriers to the creation of a truly ecologically representative protected area system - the lack of knowledge and awareness of the threats to biodiversity; poor efforts at governance; weak management structures and low participation rates; and insufficient funding (International Institute for

[73] *Effective conservation* in this context refers to area-based measures such as marine protected areas and other means of protection (UNEP/CBD/SBSTTA/10/8/Add.1, 3).

Sustainable Development 2003b, 5). (See Chapter Six for an analysis of the challenges of representative systems and system networks.

Seventh Conference of the Parties to the Convention on Biological Diversity (COP 7, 2003)

The ambitious agenda of COP 7 provided Parties with an opportunity to address one of the CBD's most significant challenges – to respond to the outcomes of the Johannesburg Plan of Implementation agreed at the 2002 WSSD with a list of concrete measures. More than 2,300 participants representing 161 governments and UN agencies, academic institutions, non-governmental, intergovernmental and industry organisations, and local and indigenous communities attended COP7 in Kuala Lumpur in February 2003 (International Institute for Sustainable Development 2004, 1).

Delegates were divided into two working groups, with each group consigned a number of issues to discuss and debate. Working Group One considered a diverse range of topics including protected areas and marine and coastal biodiversity, with the majority of participants expressing support for the creation of marine protected areas in the high seas in so far as their establishment remained consistent with the spirit and intent of the 1982 LOSC (International Institute for Sustainable Development 2004, 5). Delegates were also informed of the risks to the biodiversity of seamounts and cold-water coral communities located in areas beyond national jurisdiction in a risk management paper that was the result of a collaborative effort between the Executive Secretary of the COP and the IUCN Global Marine Programme and prepared in the light of the recommendations made during the eighth meeting of the SBSTTA (UNEP/CBD/COP7/INF/25, 1).

The paper reiterated what was seen as an urgent need to establish MPAs in the high seas, particularly in relation to vulnerable and fragile habitats, the impacts of bottom trawling, the governance of deep sea fisheries and bottom trawling on the high seas, and the critical gaps in marine scientific knowledge and ocean governance. It also suggested a number of measures which might help protect the biological health of seamounts and coldwater corals by closing the legal ‘gaps’. These measures included (UNEP/CBD/COP/7/INF/25, 7-8):

- Short and long term approaches and tools, including an immediate ban on destructive fishing practices and the establishment of marine protected areas;
- Clarification of coastal states’ authority and responsibility for protecting the biodiversity of the benthos of continental margins from destructive fishing practices such as bottom trawling;[74]
- Identification of important areas for biological diversity beyond the Exclusive Economic Zone;
- More complete and systematic collection of data on high seas fisheries;
- More complete information on the number of flag states and vessels involved in high seas fishing, and an audit of their reports to be forwarded to the appropriate international bodies;
- Adoption of international measures for the management of high seas fishing practices such as bottom trawling, which are consistent with the precautionary approach and ecosystem-based management; and
- The development of a global framework to address the full range of uses and activities on the high seas that builds on the 1982 LOSC, the 1995 Fish Stocks Agreement, the CBD, and other appropriate instruments.

Working Group One noted the concerns and sentiments articulated by delegates during the eighth and ninth SBSTTA meeting reports and reached a number of final decisions. In respect of marine protected areas beyond national jurisdiction, the COP agreed that the LOSC provides the legal framework for regulating activities and asked that the Executive Secretary collaborate with the UN Secretary General and other relevant bodies to identify appropriate establishment and management mechanisms for high seas MPAs. Regarding the conservation and sustainable use of biodiversity in the high seas and Area, the COP urged the UN General Assembly and other relevant organisations to

[74] “The concern for coastal states whose continental margin extends beyond 200 nautical miles is that high seas bottom trawling may adversely impact the biodiversity of these underwater areas and the ‘sedentary’ species such as corals, over which it exercises sovereign rights. The ambiguities regarding coastal state rights and duties vis-à-vis high seas bottom fishing in this area need to be addressed.” (UNEP/CBD/COP/7/INF/25, Footnote 30).

expedite measures to stop destructive practices through measures such as interim bans and the application of the precautionary approach (International Institute for Sustainable Development (c) 2004, 7).

CBD Ad Hoc Open-ended Working Group on Protected Areas

In decision VII/5, the seventh Conference of Parties noted the increasing risks to marine biodiversity in areas beyond national jurisdiction and the paucity of MPAs, and agreed that the time was ripe for international action and cooperation to improve conservation measures in the open oceans. To address these risks and find a way forward for high seas MPAs, decision VII/28 established an Ad Hoc Open-ended Working Group on Protected Areas (hereon known as the Ad Hoc Working Group) and adopted a programme of work. The overall objective of the programme of work, which includes terrestrial as well as marine areas, calls for:

> ...the establishment and maintenance by 2010 for terrestrial and by 2012 for marine areas of comprehensive, effectively managed, and ecologically representative national and regional systems of protected areas that collectively, *inter alia* through a global network contribute to achieving the three objectives of the Convention and the 2010 target to significantly reduce the current rate of biodiversity loss. The programme of work requires Parties to collaborate with other Parties and relevant partners through the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea to establish and manage protected areas in marine areas beyond national jurisdiction, in accordance with international law, including the United Nations Convention on the Law of the Sea, and based on scientific information (UNEP/CBD/WG PA/1/2, 2005, 1).

The Conference of Parties also suggested in decision VII/28 that the Ad Hoc Working Group examine options for cooperation for the establishment of high seas MPAs.

The Ad Hoc Working Group held its first meeting in Italy in June 2005 and released a post-meeting document titled: "Options for Cooperation for the Establishment of Marine Protected Areas in Marine Areas Beyond the Limits of National Jurisdiction" (UNEP/CBD/WG-PA/1/2, 2005). These options included:

- Inviting the UNGA and parties to the LOSC to consider the development and adoption of an implementing agreement to the LOSC for the establishment and management of MPAs beyond the limits of national jurisdiction;

- Drafting an implementing agreement to the CBD which would require amendment to the Convention to extend its jurisdictional reach to biological diversity in areas beyond national jurisdiction;
- Establishing a new mechanism under the 1972 World Heritage Convention (WHC) to enable recognition and protection of sites “of outstanding universal value” in marine areas beyond national jurisdiction, again requiring amendment to that Convention; and
- Drafting and implementing a global agreement providing for a network of subsidiary instruments in which clusters of States working within regional organisations assume responsibility for managing particular areas beyond national jurisdiction, subject to oversight by an international management body (UNEP/CBD/WG-PA/1/2, 2005, 5 and 12).

The options paper also discussed the body of scientific information about marine biodiversity in the oceans beyond national jurisdiction and highlighted a number of areas beyond national jurisdiction which Group participants believed should be targeted for conservation action, including:

- The Indo-Pacific, with a focus on South East Asia, northern Australia and the Tasman Sea;
- Seamounts in the Atlantic, and the Southern Ocean convergence zone;
- Marine areas beyond national jurisdiction adjacent to islands in the Southern Ocean; and
- Small shelf areas in the northern Atlantic.

(UNEP/CBD/WG-PA/1/2, 2005, 7).

Group participants also envisaged a longer term need for “systems of ecologically representative marine protected areas” in areas beyond national jurisdiction that would require “the development of a bioregional framework for oceans management, as well as the establishment of criteria for site selection” (UNEP/CBD/WG-PA/1/2, 2005, 8).

The use and improvement of existing instruments was also addressed by the Ad Hoc Working Group. Participants explored the potential of arrangements such as the IMO's Particularly Sensitive Sea Areas (PSSAs) and the capacity of States to tailor proposals to protect particular priority biodiversity areas both within and beyond national jurisdiction (UNEP/CBD/WG-PA/1/2, 2005, 11). The possibility of expanding the scope of the UNFSA to include all high seas fish stocks as well as extending the mandate of RFMOs to cover areas beyond national jurisdiction, and interim measures such as prohibiting all bottom trawling fisheries on the high seas were also explored, as was the potential for expanding the geographical scope of regional seas agreements to cover adjacent high seas areas (UNEP/CBD/WG-PA/1/2, 2005, 11). In relation to the regime of the Area and its resources, the possibility of establishing "a global network of hydrothermal vent sites for integrated study and long-term scientific observation" was discussed, as was the potential for excluding all activities (not just mining) in "preservation reference zones" to be established when mining commences in the Area (UNEP/CBD/WG-PA/1/2, 2005, 11). Finally, the Ad Hoc Working Group suggested that there was also:

> ... an important latitude for further collaboration among like-minded States within the framework of existing instruments to establish protective measures for specific bio-geographic regions through binding and non-binding arrangements. While such arrangements may not have any binding effect on non-participating States, they may gain wider recognition and effect through broader international agreements (UNEP/CBD/WG-PA/1/2, 2005, 12).

The Report of the First Meeting of the Ad Hoc Working Group on Protected Areas presented to the 8th Conference of the Parties to the CBD (COP8) included a statement from Norway regarding the need for a new legal framework for the establishment of high seas MPAs:

> We are not convinced...that there is a need to establish a new legal framework specifically pertaining to the establishment of high-seas marine protected areas. To negotiate amendments to existing international law would be time-consuming and difficult, and it would take valuable resources and focus away from implementing specific measures with practical results. Rather than focusing on the development of new instruments States should cooperate to utilize existing possibilities. Existing knowledge shows that the main threat to biodiversity in the oceans is unsustainable fishing practices, and the first priority must be to adjust these practices (UNEP/CBD/COP8/8, 23).

Norway's Statement was supported by Iceland.

Eighth Conference of Parties to the Convention on Biological Diversity (COP 8 2006)

As had occurred at COP7, discussions were focused on high seas marine protected areas and the question of the CBD mandate in relation to this issue, with Parties overwhelmingly supporting the fact that dialogue on marine biodiversity beyond national jurisdiction and high seas marine protected areas should continue in the framework of the UNGA (Morgera 2007, 7).

Debate on high seas MPAs at COP8 was almost completely dominated by industrialised countries, as the G77/China had afforded priority to issues concerning access to, and benefit sharing of, genetic resources. Although relevant to high seas marine biodiversity, access and benefit sharing were discussed under a separate agenda item and in a separate working group at the COP, with marine genetic resources discussed under the work programme on marine biodiversity (Morgera 2007, 8).

State positions diverged on the role of the CBD following general agreement that the UNGA was the appropriate framework for discussions on marine biodiversity and protected areas beyond national jurisdiction. Some maintained that the CBD should concentrate on capacity building within national jurisdictions and provide only scientific input to the UNGA process. They argued that the CBD's technical advice might "improperly impinge on policy or legal matters related to oceans governance", areas considered beyond the competence of the CBD (Morgera 2007, 7). Other delegates were of the view that the CBD could provide both scientific and technical input to the UNGA, especially in anticipation of reaching the WSSD 2010 target for reducing biodiversity loss and the Convention's intellectual capacity regarding the ecosystem and precautionary approaches (Morgera 2007, 7-8).

Decision VIII/24 articulates the agreement eventually reached at COP8, with the Convention having a scientific and 'where appropriate technical' role for work on high seas marine protected areas. This was premised on the expectation that the 61st session of the UNGA would follow up its own working group. The COP therefore requested that the CBD Executive Secretary: "...continue to provide relevant CBD input into a UNGA-led process", and that the CBD's lead role in relation to the application of the ecosystem and precautionary approaches be recognised in light of the 2010 target to reduce biodiversity loss (Morgera 2007, 8).

The SBSTTA Report to the Ninth Conference of Parties to the CBD

The Report on the work of the SBSTTA at its 13th meeting in 2008, presented to the ninth Conference of Parties to the CBD (COP9), included issues relevant to the implementation of the 2002 WSSD marine ecosystems 2010 target.[75] An expert working group had been convened in Portugal in 2007 to address ecological criteria and biogeographic systems for marine areas in need of protection, and the outcomes were delivered at the 13th meeting of the SBSTTA.

Members were advised that the expert workshop had developed the following scientific criteria for identifying ecologically or biologically significant marine areas in need of protection in open ocean waters and deep-sea habitats (UNEP/CBD/COP/9/3 para.57):

- Uniqueness or rarity;
- Special importance for the life-history stages of species;
- Importance for threatened, endangered or declining species and/or habitats;
- Vulnerability;
- Fragility;
- Sensitivity or slow recovery;
- Biological productivity;
- Biological diversity; and
- Naturalness

[75] 30(d) Encourage the application by 2010 of the ecosystem approach, noting the Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem and Decision 5/6 of the Conference of Parties to the Convention on Biological Diversity.

The expert working group also compiled the following criteria for representative networks of MPAs, including in open ocean waters and deep-sea habitats (UNEP/CBD/COP/9/3 para.57):

- Ecologically or biologically significant areas;
- Representativeness;
- Connectivity;
- Replicated ecological features; and
- Adequate and viable sites.

Issues relating to agricultural, inland water ecosystems, and forest biodiversity were also discussed at the 13th meeting, as were invasive alien species, climate change, and new and emerging issues relating to the conservation and sustainable use of biodiversity. In the final session (Item 6: Adoption of the Report and Closure of the meeting), Mexico's delegation expressed regret at the failure to make significant progress on most of the matters addressed, and that discussions had focused on demarcating the boundaries of the Convention at the expense of scientific debate. Mexico also added that if the SBSTTA "was unable to deal effectively with thematic programmes and cross-cutting issues... what was the point of establishing an ambitious range of targets and indicators ((UNEP/CBD/COP/9/3 para.120). Sweden echoed Mexico's view regarding the lack of scientific analysis at the meeting ((UNEP/CBD/COP/9/3 para.122). Switzerland expressed concern at the "unprecedented amount of bracketed text" being transmitted to the Conference of Parties to the CBD, adding that the SBSTTA was wasting time by renegotiating texts already agreed to by SBSTTA members ((UNEP/CBD/COP/9/3 para.123).

The list of Recommendations adopted by the SBSTTA at its thirteenth meeting included Recommendation XIII/3: Options for preventing and mitigating the impacts of some activities to selected seabed habitats, and scientific and ecological criteria for marine areas in need of protection and biogeographic classification systems. This was taken to the ninth meeting of the Conference of Parties to the CBD (COP9) together with draft scientific criteria for identifying ecologically or biologically significant marine areas in need of protection [in open-ocean waters and deep-sea habitats][76] (Annex 1 of the Recommendation and Criteria); scientific guidance for selecting areas to establish a representative network of marine protected areas, including in [open ocean waters and deep-sea habitats] (Annex II of the Recommendation and Criteria); and four initial steps to be taken in the development of representative networks of MPAs (Annex III of the Recommendation and Criteria). The latter suggests:

1. Scientific identification of an initial set of ecologically or biologically significant areas using the criteria outlined in Annex I and applying the precautionary principle.
2. Develop/choose a biogeographic, habitat and/or community classification system, entailing separate pelagic and benthic realms;
3. Drawing upon steps 1 and 2, iteratively use qualitative and/or quantitative techniques to identify sites to include in a network; and
4. Assess the adequacy and viability of the selected sites.

The scientific criteria contained in Annex I and the guidance in Annex II were adopted at COP9 and the four steps contained in Annex III were bracketed and noted. Parties to the CBD, the FAO and other relevant stakeholders have been invited to submit their views on, and experiences of, the criteria contained in the Annexes to the Executive Secretary of the CBD in preparation for COP10 (October 2010) (UNEP/CBD/COP/DEC/IX/20, 2008).

Conclusion

While not an exhaustive representation of discourse relating to the creation of marine protected areas in areas beyond national jurisdiction between 2003 and 2008, the summaries in this chapter demonstrate emergent and distinct patterns of behaviour in international fora addressing the conservation of high seas biodiversity, and in particular relating to high seas MPAs. These patterns of behaviour have been driven by the growing influence of the high seas epistemic community's language and terminology –

[76] Bracketed text in this paragraph reflects the bracketed text in Recommendation XIII/3.

its tags and building blocks – in the more ‘formal’ action settings of the global oceans governance *cas*.

Some legitimate and pragmatic ideas, proposals, and recommendations have emerged from the intellectual and social capacity-building exercises described above. The concept of pilot high seas MPAs was examined at the 2003 Malaga Workshop with participants developing draft Plans of Action for distinctive geomorphic features which might serve as ‘test cases’ to expedite future high seas MPA design, management and enforcement (Gjerde 2003b, 2, 8-19). Pilot high seas MPAs were also discussed at the 2003 Cairns Workshop, the 2005 IUCN 5th World Parks Congress, the 2006 meeting of the UN Ad Hoc Open-Ended Informal Working Group and the CBD’s Ad Hoc Technical Expert Group on Marine and Coastal Protected Areas. The 2003 Cairns Workshop for instance, focused exclusively on high seas governance issues and the high seas epistemic community maintained a high profile among participants from major maritime states, UN institutions, the scientific research community and representatives from international environmental organisations.

The high seas epistemic community’s influence is evident in the range of actions agreed at the Cairns Workshop, including:

- A moratorium on “destructive” fishing practices in the high seas;
- Development of pilot high seas MPAs;
- Amendment of the CBD to provide a framework for establishment of high seas MPAs and ecosystem management in areas beyond national jurisdiction; and
- Development of agreements to ensure implementation of the 1982 LOSC conservation obligations (Cairns Workshop Summary Record 2003).

When taken into consideration with the plethora of existing instrument, agreements, institutions, actors and emergent behaviours that are components of the global oceans governance *cas,* there is scope for a reservedly optimistic assessment for the future of marine biodiversity and habitats in the high seas, although this optimism is not inspired by the macro-goals emerging from oceans governance conferences and meetings.

Rather, it is an expression of faith in the value of change by degrees which is the focus of Chapter Seven.

The IUCN 5th World Parks Congress held in 2003 demonstrates how ambitious the international ocean governance agenda had become among the 'macro-goal champions', with a call for between 20 and 30 per cent of *all* marine habitats to be included in networks of MPAs (Gell and Roberts 2003 emphasis added), and of course, reiteration of the macro-goal of *a global representative system of MPAs by 2012*. The 5th Congress also developed a suite of strategies, accords, tool boxes, and plans of action defined by temporal targets and promoted by newly formed task forces. The macro-goal had a critical mass ready and willing to defend it.

While the growing influence of the high seas epistemic community is evident in the more 'formal' meeting summaries outlined in this chapter, the concerns of some states were also rising exponentially. There was apprehension regarding proposals for high seas MPAs, debate regarding the institutions identified as having the capacity to implement them, concern about the possibility of an implementing agreement to the 1982 LOSC or creation of a new legally binding agreement to establish high seas MPAs, and divergence regarding the scope and competency of the CBD in biodiversity issues beyond national jurisdiction. It is unlikely that these issues will subside in the near future.

The next chapter deconstructs the semantics of high seas MPA discourse, in particular the meaning of the *global representative system of MPAs by 2012* tag. It also discusses the adaptive capacity and 'fitness' of the high seas epistemic community in the hierarchical organisation of the global oceans governance system, and analyses the challenges of taking a fixed, finite and linear approach to oceans biodiversity protection. This is discussed within the frame of the *cas* paradigm and with the help of Young's examination (2004) of how the operation of environmental regimes and institutions influence the growth and dissemination of knowledge.

CHAPTER SIX

HIGH SEAS MARINE PROTECTED AREA DISCOURSE ANALYSIS

Introduction

The complexity inherent in *cas* behaviour determines how we approach investigation and analysis of the *cas* network: the investigator can either focus on behaviour of the parts as a result of their connections through the network, or examine how the behaviour of the system as a whole behaves because of the parts and the network (Bar-Yam 2005). This chapter takes the former approach – focusing on the behaviour of the parts as a result of their connections through the network - by examining the ‘fitness’ of the *global representative system of MPAs by 2012* tag in the global oceans governance *cas* and the adaptive capacity and ‘fitness’ of the high seas epistemic community in the hierarchical organisation of the global oceans *cas.* Young’s examination (2004) of how the operation of environmental regimes (institutions) influences the growth and dissemination of knowledge also helps explain why there is a dominant discourse framing discussions of high seas MPAs in international fora.

High seas MPA discourse requires deconstruction, analysis and critique to identify the rhetorical gaps between the *idea* of high seas MPAs, which many believe is one whose time has come, and their *realisation.* This can be teased out by using the elements of complex adaptive systems theory, with particular emphasis on the metaphors the *cas* literature offers.

Paradoxes soon become evident. The goal of *a global representative system of MPAs by 2012*, and the high seas epistemic community’s preferred approach to achieving this system is at odds with the emergent behaviours of other components of the global oceans *cas*. The goal, or *tag* as is argued below, is a fixed and finite concept trying to maintain its niche in a transitional, adaptive, perpetually novel global oceans complex system which can never optimise its fitness because of the dynamic nature of the system itself. Likewise, the high seas epistemic community's calls for high seas MPAs to be 'legitimised' in a global legally binding instrument or implementing agreement to the LOSC represents a linear, traditionally hierarchical and control-from-the-top focus in a complex adaptive system that is dynamic and dispersed. The former cannot 'fit' with the latter. The high seas epistemic community, like many if not all international environmental non-government organisations, is motivated by eco-ethical idealism and belief in a traditional stylised view of international law on the one hand, while being disappointed with the efficacy of the global and regional instruments already in place on the other.

Precepts and Paradoxes

The Primary Tag in High Seas Marine Protected Area Discourse

As Chapters Four and Five demonstrated, the most prominent MPA advocacy tag that has emerged over several decades to achieve primacy in high seas marine protected areas discourse is the 'macro-goal' of a *global representative system of marine protected areas by 2012*. The tag has various permutations, and frequently includes the term 'networks' (*a global representative system of MPA networks by 2012*) however the scope (global), the approach (representative) and the temporal ambition (by 2012) contained within the tag remain the same. As discussed below, the frequent inclusion of *networks* in the tag serves to bolster its eco-ethically premised ambitions contained while further complicating its chances of achievement.

Since 1975, when an IUCN technical workshop in Tokyo embraced the concept of *a global representative system of marine protected area networks*, the high seas epistemic community has, through repeated use of its primary tag – the *global representative system of marine protected areas by 2012* – rendered the majority of other high seas MPA ideas and proposals largely redundant, that is, peripheral to its 'truth' of the system. As an adaptive agent itself, the high seas epistemic community has undertaken what any adaptive agent undertakes intuitively, and which is most eloquently captured by Simon: "Given a desired state of affairs and an existing state of affairs, the task of an adaptive organism is to find the difference between these two states, and then to find the correlating process that will erase the difference" (1962, 479). The high seas epistemic community believes that achieving *a global representative system of MPAs by 2012* together with a legally binding mechanism for high seas marine protected areas, represent significant parts of the correlating process that will erase the difference between ineffective and effective conservation of biodiversity in areas beyond national jurisdiction. A *global representative system of MPAs by 2012*, especially one legitimised through a legally binding agreement, is envisaged by proponents to be the leverage point that will contribute to large, directed changes in the global oceans *cas* itself.

The high seas epistemic community's peripheralisation of alternatives not directly in concert with its goal of *a global representative system of marine protected areas* has occurred quite swiftly, especially since the 2002 World Summit on Sustainable Development (WSSD) legitimised the concept *of a global representative system of MPAs* and added the aspirational date of 2012. Tags are functional mechanisms because they facilitate *selective* interaction, thereby enabling agents to aggregate. Interaction between agents in the aggregate – in this case, the high seas epistemic community – involves filtering of information, specialisation, and cooperation between agents and between aggregates in the network and within the system. The influence of the high seas epistemic community's priority social goal on the broader global oceans governance complex adaptive system cannot be overstated, revealed as it is in the repetitiveness and regularity with which the primary tag of *a global representative system of MPAs by 2012* (and its various permutations) now appears in meeting records and associated literature when discussions are focused on, or turn to, the conservation of biodiversity in areas beyond national jurisdiction. This primary tag has captured contemporary discourses relating to the creation of high seas MPAs in the international oceans governance arena. It has helped agents identify other agents that possess transactional utility and recognise those who might prove useful as destination points for flows of information and/or materials (Holland 1995, 14-15). As Holland reminds us, useful tags flourish through a system of self-reinforcement while those identified as having minimal or no utility evolve out of the system and eventually disappear. This is discriminatory behaviour borne of experience, adaptation, and necessity – real or perceived – over time. It can be seen in the determination of the high seas epistemic community, through various oceans governance fora, to keep the primary tag at the centre of oceans conservation and governance discourse. The high seas epistemic community has created a niche for itself in the global oceans governance system, and a niche for its primary tag within the discourses of this system. The key issue in this chapter is to analyse the fitness and adaptive capacity of the high seas epistemic community's primary tag, and establish whether this fixed, finite and seemingly immutable tag can help the community maintain its niche, and therefore its relevance, in a global oceans governance complex adaptive system

Regimes, Institutions and the Growth and Utility of Knowledge

Applying Young's examination of how the operation of environmental regimes and institutions influences the growth and dissemination of knowledge (2004) helps explain why and how the high seas epistemic community's primary tag has endured in high seas MPA discourse. His argument is premised on three propositions and their policy implications. His strategy is to "turn the causal arrow around" from the paradigm in which "knowledge systems affect the character of specific institutions" and ask instead "how the operation of environmental regimes influences the growth and dissemination of knowledge" (Young 2004, 216).

Young's propositions do not ignore the reality that environmental regimes reflect the preferences of actors or interest groups able to exercise power and influence during regime formation, however, he is of the view that even powerful actors are constrained by their understanding of the institutional options available to them, and that this fact emphasises the role of knowledge in institutional growth (2004, 216).

Institutions are described as "collections of rights, rules, and decision making processes governing human actions in specific issue areas" and are understood as social constructions (Onuf 1989). International institutions are "social institutions governing the activities of the members of international society" (Young 1989, 6). Regimes, according to Young, are like other social institutions in that they "may be more or less formally articulated, and they may or may not be accompanied by explicit organisations" (1989, 13). He also adds that:

> ...when a regime is articulated formally in a contract or treaty, informal rules typically grow up in conjunction with the resulting institutional arrangement in practice. This fact suggests the importance of a *behavioural approach* to the empirical identification of regimes (Young 1989, 13 footnote 5, emphasis added).

While it may seem that the following analysis is twisting Young's causal arrow back 180 degrees, it seems reasonable to describe the high seas epistemic community as an institution which has emerged simultaneously with the growth of the global oceans governance *cas,* especially over the last two decades. The tags and building blocks the high seas epistemic community employs (and which define it as an agent in the global oceans governance *cas*), and the patterns of behaviour it exhibits represent a collection of rights, rules, and decision making processes that govern the community's actions in the issue area of high seas marine protected areas. After all, as described in Chapter Three, one of several universal themes in descriptions of complex adaptive systems is that basic components and laws (rules) interact more or less simultaneously within the self-organised complex adaptive system and that multiple options for interaction are also presented by the system itself (Waldrop 1992, 86).

Young reminds us that while institutions are not actors in their own right, they provide the rules of the game under which actors pursue their individual goals (Young 1999). This thesis highlights "the importance of a behavioural approach to the empirical identification of regimes" (Young 1989, 13 footnote 5). Chapters Four and Five demonstrated how the boundaries between *regime* and *institution* in the global oceans governance *cas* have become increasingly blurred, not least because of the growing influence of international environmental NGOs in multilateral governance fora. While this chapter explores, analyses and critiques the rules of the game that the high seas epistemic community have established in high seas MPA discourse, Chapters Four and

Five demonstrated how the causal arrow now swings full circle, with international regimes such as the CBD and the UN's oceans working groups reflecting the knowledge systems that affect the character of specific institutions, and specific institutions affecting the character of knowledge systems.

Young's First Proposition

Young's first proposition is that: "International environmental regimes affect the growth of knowledge by structuring research agendas and, as a consequence, influencing what is studied" (2004, 217). One of the most direct roles of institutions centres on the ways in which structural approaches to knowledge frame issues and direct resources toward improving our understanding of priority issues, irrespective of whether this approach proves successful in solving the problem (2004, 217). Institutions also play a role in focusing attention on particular aspects of larger issues and problems, and they exert substantial influence on the development and diffusion of analytic tools and policy-relevant models (2004, 218). For instance, the ecosystem model approach to large scale management existed long before it was adopted by the 1980 Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), as did the biodiversity regime created under the CBD but the incorporation of these paradigms into major environmental regimes has encouraged a significant body of research into their efficacy and increased the "salience and legitimacy of these models in the minds of scientists and policy makers alike" (Young 2004, 218).

Young's Second Proposition

Young's Proposition Number Two is as follows: "International environmental regimes influence the growth of knowledge by privileging certain types of knowledge claims and, as a result, affecting how key issues are studied" (Young 2004, 220). Young arrived at this proposition by observing how institutions often privilege certain types of knowledge claims and in the process, weaken or peripheralise others, his example being that of the primacy that environmental regimes afford western scientific knowledge over that of traditional ecological knowledge (2004, 220). This type of 'knowledge privileging' was demonstrated in the "call for action" arising out of an IUCN WCPA –

Marine Summit convened in Washington DC in April 2007. The WCPA – Marine, a key participant in the high seas epistemic community, brought together "...50 of the top marine conservation experts drawn from government, intergovernmental, non-governmental organisations and academia" to share the latest scientific evidence of "increasing pressures and damages from human activities in the high seas". The scientific experts:

> ...expressed grave concern that the pace and scale of changes to our oceans are far outstripping current efforts to protect marine ecosystems and the life-providing ecosystem services upon which we depend. Entire ecosystems in the high seas are being damaged and lost before we have even acted to protect them (WCPA – Marine 2007).

Young notes a similar phenomenon occurring in relation to the selection of policy instruments and the growing body of evidence indicating that informal management practices which evolve over time to guide human uses of natural resources can produce outcomes that demonstrate sustainability. Young adds, however, that some resource regimes (and here one assumes that Young is referring to those that appropriate resources and those who advocate resource protection) have difficulty acknowledging this (2004, 220).

Also informing Proposition Number Two is Young's observation that a consequence of the development of international environmental regimes is the growing interest in integrated scientific assessments – oft quoted by environmental NGOs to support their case for international intervention – which has emerged simultaneously with a marked preference "for the development of quantitative analyses and construction of analytically tractable models" (2004, 221). While acknowledging that integrated scientific models and assessments have their place, he also notes that they exert pressure on actors to arrive at consensus in situations where available knowledge is insufficient to warrant accord, and that the results of such assessments can be manipulated by actors seeking their own agendas (2004, 222).

An example is the call for high seas MPAs based on integrated assessments of deep oceans biodiversity despite only a little more than 0.00001 per cent of the deep oceans having been biologically investigated. The distinction between *assessments* and *investigations* should not be underestimated in high seas MPA discourse, as the former usually relies on educated assumptions and far less empirical research than the latter. This is especially so in the field of MPA research where the proliferation of models far exceeds that of empirical field studies, especially the use of fisheries models to demonstrate the perceived benefits of marine spatial closures. Following an extensive study of the body of 'scientific' literature addressing MPAs, Willis et al (2003) concluded that the *raison d'être* for much of the MPA modelling and theoretical work was advocacy for the establishment of marine reserves in areas that lacked them rather than any bona fide attempt to contribute to MPA science (2003, 97). The upshot of the dearth of empirical field data is that model assumptions have evolved into conventional paradigms, and the conclusion among MPA advocates that if everybody says it, then it must be true (Willis et al 2003, 98).

A classic example of a model assumption evolving into a conventional paradigm, and one which is still used frequently by MPA advocates, including those in the high seas epistemic community, is that of the 20 per cent no-take MPA recommendation. As Agardy et al note, this figure was extrapolated from:

> ... very specific localized studies of particular fisheries within particular habitats, not from representative community ecology data from a wide range of habitat types. The initial science concerning minimum no-take determinations included home range studies and population dynamics data that were used to predict the minimum area needed to reach a particular fisheries management goal (i.e. sustainability) [with the original authors supporting] a goal of fully protecting a minimum of 20-30 % of coral reef habitat *until better estimates are obtained* (2003, 359-360, emphasis added).

The 20 per cent figure has become a primary tag of MPA advocates working to implement a range of broad objectives under a diverse continuum of social and ecological conditions. This figure is all the more confusing when the objectives are opaque and the reasons for requiring a minimum of 20 per cent of the MPA area be dedicated to no–take reserves in order to be effective lacks empirical and case specific detail upon which to base policy decisions (Agardy et al 2003, 360). MPA proponents blindly advocating the 20 per cent minimum run the very real risk that this formula may not meet expectations, thereby alienating any further public and political support for MPA development (Agardy et al 2003, 361). The 2003 WPC had recommended that at least 20 to 30 per cent of all marine habitats be included in MPA networks, although many participants viewed this figure as conservative following a review of "nearly forty studies examining how much of the sea *should* be protected (Roberts, Mason and Hawkins 2008, emphasis added).

Young's Third Proposition

Young's Proposition Number Three is that: "International environmental regimes affect the growth of knowledge by guiding applications of knowledge to public issues, and as a consequence, enhance the credibility of favoured streams of research" (2004, 222). Most regimes comprise portals that afford structure to the science/policy interface, and the characteristics of these portals – for instance, the tags used to describe them – affects the incentives of those who produce knowledge. The 2003 Coos Bay Statement of Concern, directed to the United Nations Secretary General and circulated to media outlets worldwide by a group of deep sea research scientists, provides evidence of this (see Chapter Five for details). Even though the research driver might be a single issue, the knowledge needed to address this issue will be sourced by numerous and distinct knowledge hunters and gatherers working in diverse fields of research, therefore the conclusions they reach will, or should, vary markedly. To give the impression that all (research) roads lead to Rome and to downplay controversy or disagreement, international environmental regimes will, on occasion, pressure the producers of knowledge to converge their results (or, alternatively, undertake convergence of their own accord) to demonstrate that consensus has been achieved among actors in the scientific community. Young is of the view that this is cause for concern as it can provide a disincentive to those in the broader church of knowledge hunters and gatherers to continue amassing information about the issue at hand (2004, 223).

While the success or failure of international environmental regimes is often difficult to gauge, there is a raft of evidence demonstrating that their institutional arrangements have contributed significantly to the growth of knowledge about complex issues (Young

2004, 224-25). There are, however, examples of international environmental regimes demonstrating "an inverse relationship between the effectiveness of regimes measured in terms of problem solving and the roles these regimes play in catalysing the growth of knowledge" (Young 2004, 225). In other words, when an existing model and analytical technique produces acceptable outcomes, there is little incentive to adopt a critical perspective or search for alternative means of understanding the problem (2004, 225). A perverse outcome is that the existing model sets a precedent for the development of future models, and as such, can give rise to 'lazy' and expedient policy making.

The WCPA - Marine supplies oxygen to Young's propositions and conclusions on the growth and privileging of knowledge in international environmental regimes. A key component of the WCPA - Marine Plan of Action is expansion of the membership of WCPA – Marine (2006, 10-11) to include leading experts that:

- Advise on marine ecology/economics and sociology that underpin MPAs;
- Are the policy advisers and decision makers that decide on MPAs;
- Manage MPAs and the associated process;
- Undertake fundraising and have the skills to synthesise and present complex issues in a simple manner to a broad audience;
- Are the advisers in other sectors that provide valuable contributions to the development of MPAs, such as fisheries, tourism and shipping; and
- For those countries currently without MPAs, have the potential to lead the MPA process for their country if the opportunity to do so arises.

The Plan also envisages a minimum of three members from every coastal country around the world (2006, 11).

While there is nothing in the Plan demanding that membership rest on the applicant's subscription to *a global representative system of MPAs by 2012*, the mission statement –"to promote the establishment of a global, representative system of effectively managed and lasting networks of MPAs, as an integral part of the IUCN mission" (2006, 7) – and the membership wish list certainly imply it. Members' input would be integral to the creation of a Plan of Action framework and outcomes are to be designed to: (i) improve the coverage of existing instruments and agreements; (ii) obtain greater effectiveness from the work of WCPA – Marine; and (iii) sustain this effectiveness into the future (Laffoley 2006, 12). The Plan of Action also invites members to identify future priorities for WCPA – Marine work, and emphasises the need to "ensure that ... proposals are high level and strategic, in that they address or support MPA issues across significant parts of WCPA – Marine regions, the region as a whole or at even more global scales", and are tied into the ecosystem-based WCPA Marine regions (2006, 16-17). This leaves little doubt that new members of WCPA – Marine will be disciples of the primary tag, and that the knowledge they gather will be grist to the high seas epistemic community's mill. WCPA – Marine will be preaching to the converted.

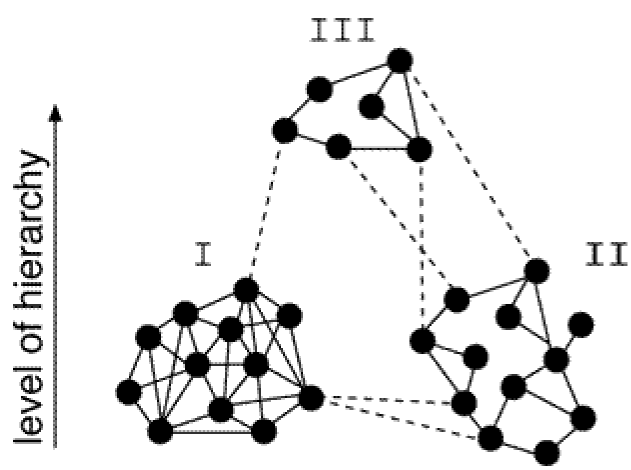
The hierarchical arrangement of global oceans governance complex adaptive system and the fit of the high seas epistemic community

As described in Chapter Three, the key to demarcating hierarchical levels in complex adaptive systems is to recognise patterns and use them as the basis for analysis – simplification is central to explanations of *cas* behaviour. This involves identifying which peripheral details can be eliminated without losing the 'truth' of the system and then sorting agents into aggregates in order to simplify the task of recognising patterns and behaviours. We can identify patterns because we have the capacity to recognise repetitiveness, regularities and relationships.

Complex adaptive system hierarchies are composed of inter-related subsystems nested at higher and higher levels. Agent behaviours are aggregated and classified according to rates of agent interaction, as demonstrated by the emergence and nesting of the high seas epistemic community (aggregate) within the larger global oceans governance *cas*. Aggregates (subsystems) that occupy the global oceans governance *cas* include, inter alia, the shipping and marine mining industries and their representative bodies, commercial fishers represented through regional fisheries management organisations (RFMOs) or other industry aggregates, nation states, bioprospectors, deep ocean research scientist aggregates such as InterRidge, the UNGA, the Conferences of Parties to the CBD, the IMO, regional organisations, international marine policy practitioners and academics, environmental non-government organisations, and international maritime legal practitioners and jurists. There is also a plethora of secretariats and administrative bodies tending the many legally binding and voluntary arrangements intended to control human activities in waters beyond national jurisdiction. These aggregates are sufficiently discrete subsystems that are laterally or vertically hierarchically nested according to rates of interaction. The rate of interaction within these aggregates is more frequent and rapid than what takes place between them, reminding us of Overton's observation that "the structure imposed by differences in rates [of interaction] is sufficient to decompose a complex system into organisational levels and into discrete components within each level" (1974, in O'Neill et al 1986, 76).

Figure 4 (first depicted in Chapter Three) presents a simple interpretation of the hierarchical levels and topology (rates of connectivity and interactivity) of a *cas*. The hard lines represent rapid and frequent internal rates of interaction while the broken lines represent less frequent and slower rates of interaction.

Figure 4: Levels of hierarchy in a *cas* (Resilience Alliance 2003)



Level I in Figure 4 for example, might represent key agents in the marine biodiversity conservation community (of which the high seas epistemic community is an agent, with each agent represented by one dot), while Level II might represent, for instance, an aggregate of regional fisheries management organisations, or an NGO conglomerate such as the Deep Sea Conservation Coalition. Within the aggregate we find rapid rates of interaction, transaction and response times between agents, or, as described in Chapter Three, ‘short run behaviours’. The patterns arising out of short run behaviours permeate broader system scales but at a much slower rate, hence the broken lines. Rapid interaction rates should fuel innovation, experimentation and adaptation, with smaller subsystems changing more quickly that the larger systems within which they are nested, although in the context of global oceans governance, much depends on the drivers for interaction and the substance of flows of information. If the agent does not spend a portion of its efforts adapting to other agents, these periods of dormancy will eventually render the agent redundant, that is, peripheral to the truth of the system, and new ideas and agents will move to occupy the previous agent’s niche.

The interaction between Levels I and II are lateral, although less frequent and rapid than what occurs within each level. Level III might represent a regional governance institution such as OSPAR, or perhaps a global institution such as the UNGA. The levels of vertical interaction between Levels I and II and then upward to III are even less frequent and more filtered, measured perhaps by the number of meetings between parties or driven by the need to interact and respond to new demands. It might also be demonstrated in the propensity for international negotiations to facilitate consensus, arrive at lowest common denominator outcomes (a by-product of filtering) and sustain interaction between levels. Again we return to the insight of Norton and Ulanowicz (1992, 244) who assert that “the best description of a system is one that describes dynamic processes on a scale determinative of priority social goals.” If evidence suggests that high seas MPAs are needed in a particular marine region, then the Secretariat of a regional aggregate, or the Parties to a particular instrument or convention, may consider this a potential priority social goal meriting discussion, thereby prompting interaction between aggregates (subsystems) within the *cas* which will filter up to the aggregate (meeting) convened to discuss the issue and then possibly on to the decision-making aggregate (for example, OSPAR) to determine the proposal’s fate.

As highlighted in Chapter Three, hierarchical organisation in the context of *cas* is not that of the formal top down, authoritative definition, where control is exercised from 'on high' to the lower levels, but is instead composed of interrelated subsystems nested at higher and higher levels where agent behaviours are aggregated and classified according to rates of agent interaction, that is, strength of relationships. Theories of hierarchical organisation are essentially theories of observation of scale, the latter being "the spatial extent, time, momentum, duration and energy of a behaviour" (Bar-Yam 2005, 5). The emphasis in *cas* remains on non-linearity. Even though the behavioural patterns of the high seas epistemic community can be explained by its position in the global oceans governance *cas* hierarchy (that is, nested deeply within it), its approach to the creation of high seas marine protected areas indicates a preference for linearity as demonstrated by its preference for achieving high seas MPAs through legally binding, top down, cause-and-effect, and eco-ethical authoritative arrangements such as an implementing agreement to the 1982 LOSC, extension of the mandate of the CBD to cover areas beyond national jurisdiction, or a global high seas MPA legally binding arrangement.

The high seas epistemic community's preference for a legally binding instrument to validate the primary tag *of a global representative system of MPAs by* 2012 is discussed in more detail below, but suffice to state at this point that MPA advocates frequently overlook the relationships between parts of the system, focusing instead on the perceived failures or inadequacies of its parts, such as the criticism of fisheries management organisations and instruments by environmental NGOs.

Although the 2003 Malaga Workshop, the Vilm Workshop and WCPA – Marine have explored the concept of pilot high seas MPAs, discussions continue to be in the context of *a global representative system of MPAs by 2012*. The macro-goal nature of the primary tag marginalises the potential for emergence of high seas MPAs through incremental and pragmatic measures such as a high seas MPA innovative prototype built on informal agreement, designed to test political will and capacity and inform adaptive management of human activities that impact on organisms and geomorphic features in areas beyond national jurisdiction. While the high seas epistemic community has discussed the potential for a cluster of pilot high seas MPA sites as test cases, no further steps have been taken to progress the idea beyond agreement that they are needed in the short term. As such, there remains a significant gap between rhetoric and action.

If history has taught us anything in international relations, especially in the context of marine environmental law and policy, it is that the more ambitious the agenda, the rockier the road on which agents must travel to achieve an outcome that is usually that of the lowest common denominator. Nothing demonstrates this more than the convoluted, contentious and challenging path toward realisation of the LOSC, and the compromises and lowest common denominator outcomes agreed to finalise the Part XI Implementing Agreement. If the ecological health of the oceans is as parlous as the high seas epistemic community claims it to be, why is the most complex and challenging of measures (a legally binding agreement; implementing agreement to the LOSC; or extension of the mandate of the CBD) being advocated as the ultimate form of protection?

The epistemic community's focus on cause-and-effect relationships and relative measures is also problematic. For example, the high seas epistemic community is deeply concerned about the damage inflicted by bottom trawling on the deep ocean benthos and organisms located in areas beyond national jurisdiction. The DSCC waged a long and rigorous campaign to have the practice banned through a resolution at the UNGA. The cause-and-effect approach was that bottom trawling causes damage, ergo bottom trawling should be banned. A linear cause-and-effect argument offers no middle ground, demonstrates little or no faith that agents can change behaviours, and reduces the argument to a fixed pair of binary opposites in the hope of raising awareness and achieving a desired outcome, in this case a moratorium on bottom trawling.

The efforts of the DSCC to have a moratorium on high seas bottom trawling were not rewarded at the 59th UNGA despite recommendations from oceans governance fora for adoption of an interim ban. There were also expressions of support for the resolution from a number of state delegations during UNGA proceedings, as well as the Coos Bay

Statement of Concern, and the Scientists' Statement on Protecting the World's Deep-Sea Coral and Sponge Ecosystems. The expert statements presented at the 59th UN General Assembly represent the type of knowledge privileging discussed by Young in his examination of how the operation of environmental regimes (institutions) influences the growth and dissemination of knowledge (2004), as does the environmental NGO's media campaign to highlight the 2001 Scientific Consensus Statement on Marine Reserves and Marine Protected Areas discussed in Chapter Four.

The moratorium was discussed again at the 61st UNGA, resulting in UNGA resolution 61/105. Adopted in December 2006, it calls on States and regional fisheries management organisations to implement certain measures by 31 December 2008 or prohibit high seas bottom fishing. Parties are required to conduct environmental impact assessments of individual high seas bottom fisheries to prevent significant adverse impacts on vulnerable marine ecosystems, or cease to authorise vessels that fly their flag and bottom trawl in the high seas (Deep Sea Conservation Coalition 2009). The environmental NGO, TerraNature, described resolution 61/105 as "pathetic" and a "tragic setback for the protection of high seas biodiversity" (2006). The Pew Charitable Trusts, which provides financial support to the DSCC, has been more circumspect about the campaign to halt bottom trawling in the high seas, acknowledging that while it did not succeed, the campaign was "pivotal in rapidly advancing the issue of constraining bottom trawling on the international fisheries agenda" (Scrivner and Baxter 2009). There are incremental and positive behavioural changes being implemented by RFMOs to protect vulnerable and fragile habitats and geomorphic features in their respective high seas areas. There continues to be significant flow-on effects from the campaign without the need to oblige or commit countries to action through strongly worded resolutions.

Flows within the high seas epistemic community

As discussed in Chapter Three, flows are considered a property of *cas* rather than a mechanism. Flows have two sub-properties: (i) the multiplier effect; and (ii) the recycling effect (Holland 1995, 23). In the global oceans governance *cas*, flows of information, material, dialogue and tags are both recycled and multiplied, depending on their characteristics and their purpose.

The IUCN introduced the concept of *a global representative system of marine protected areas* in 1975 and its involvement in various oceans fora since this time has provided it the opportunity to advocate and promote the concept and swell the ranks of proponents, thereby resulting in a multiplier effect. The primary tag of *a global representative system of MPAs by 2012* has filtered laterally and vertically through the oceans governance *cas* hierarchy to other subsystems, aggregates, and agents in the oceans governance domain eager to discuss and debate ways of conserving oceans biodiversity – flow targets are identified by their tags, or by the process of tagging itself.

The recycling effect is evident in the recycling of ideas and tags. As previously alluded to, *a global representative system of MPAs by 2012* and its permutations has been recycled to the point where it has rendered largely redundant other proposals and ideas not in concert with the primary tag. Arguably, it has exhausted its supply of nodes for multiplying, and become a product of the recycling effect. Recycling becomes homogenised and circuitous in human social *cas* when the same options (tags) are discussed repeatedly, agreed to over and over again, but with little or no movement that might prove the circuit breaker. A system of recycled flows has the potential to become closed and impermeable, with less and less capacity for external feedback or for the creation of heterogenous feedback loops and multiplier flows. Ideally, agents use positive and negative feedback from the environment and from other agents and systems to assess their impact on the system, as input into their internal models, and as reinforcement for the creation of strategies designed to address future problems. The emphasis in the context of this thesis is that negative feedback can have a positive effect by either reinforcing the strength of ones convictions, or by providing more viable alternative strategies with which to address problems.

In a nutshell, feedback implies that both agent and system possess the capacity to be flexible and reassess current strategies to ascertain whether they are redundant and can therefore be shed without losing the ‘truth’ of the system. Redundancy creates new niches within which to position and promote fresh approaches to persistent problems. This is diversification, and diversity is critical to the survival of a *cas*. It seems, however, that the high seas MPA discourse, driven largely by the epistemic community’s agenda and its reverence for its primary tag, has evolved into a largely closed feedback loop with few entry points for alternative approaches to conservation of biodiversity in areas beyond national jurisdiction. One need only re-visit Young’s proposition regarding the privileging of certain types of knowledge to explain why alternative approaches and counter-arguments are dismissed or marginalised as being peripheral to an agent’s ‘truth’ of the system.

The high seas epistemic community-as-agent occupies a niche in the global oceans governance *cas*. As noted by Holland, the persistence of any agent: “...depends on the context provided by other agents. Roughly, each kind of agent fills a niche that is defined by the interactions centring on that agent” (1995, 27). The primary tag of *a global representative system of MPAs/MPA networks by 2012* provides context for the high seas epistemic community. As we edge closer to 2012, however, and with no high seas MPAs established thus far, the primary tag is in danger of losing its relevancy and legitimacy, and the community may find itself struggling to keep its niche if it persists with its current campaign, bearing in mind that while the removal of one agent creates a temporary vacuum, it will be filled by another courtesy of a flurry of new interactions, adaptations and ideas.

The Concept of Networks of MPAs

The term *network* has been incorporated arbitrarily into the *global representative system of MPAs by 2012* tag since its inception in 2002, and the high seas epistemic community now includes *network* or *networks* consistently in the literature addressing high seas MPAs. Indeed, it is now an accepted term in fora addressing oceans conservation. For example, in the Addendum to the Report on Oceans and law of the sea for the 62nd session of the UNGA, representative networks of marine protected areas are described as comprising either numerous small sites or few large-scale areas encompassing a large marine ecosystem or part thereof “possibly linked by ecological corridors”, and that as such, protected areas are “one of the tools that can be used to implement integrated ocean management and ecosystem approaches” (paragraph 126, A/62/66/Add.2).

The IUCN describes MPA networks as:

> ...a collection of individual marine protected areas operating cooperatively and synergistically at various spatial scales and with a range of protection levels in order to fulfil ecological aims more effectively and comprehensively than individual sites can alone. The network will also display social and economic benefits though the latter may only become fully developed over long time frames as ecosystems recover (IUCN 2007, 3).

The IUCN envisages MPA networks at a regional level, linking individual areas and comprehensively representing the region’s spectrum of marine life characteristics, with a global system of MPAs most likely consisting of clusters of regional and national networks distributed across the world (IUCN 2007, 3).

WCPA-Marine, in its Plan of Action, explains the criticality of MPA networks as follows:

> The contrasting combination of the physical connectivity of seawater combined with the increasingly known genetic isolation of marine species means that networks of MPAs are vital tools to support marine ecosystem health. Networks of MPAs, within single ecosystems but spanning entire seas and ocean realms (such as the High Seas), are necessary to ensure that biological connections are maintained between interdependent MPAs. A common example is where larvae from one MPA support populations of one or more species within other MPAs (Laffoley 2006, 7).

The concept of networks in the context of high seas MPAs requires deeper analysis and deconstruction. While it appears to fit neatly with ecosystem approaches to management and the holistic approach that many environmental non-government organisations favour, on closer examination it has significant limitations, represents a single species focus by default, and therefore ultimately contradict the drivers behind calls for the creation of networks of marine protected areas.

While the IUCN definition of an MPA network might be appropriate at a relatively small scale such as the Great Barrier Reef, it is difficult to imagine how it might be achieved at a regional or larger scale, not least because of the lack of biological data upon which to base the preconditions for networks. The biggest challenge posed by lack of biological data is determining how many species and ecosystems would benefit by the creation of an MPA network. Indeed, it is difficult to imagine what an MPA network might look like, or what it might achieve.

In the network literature, the points where flows intersect are referred to as *nodes*. In *cas*, nodes are agents and as we have already discovered, agents are the key leverage points for action and interaction within the system. The paths that enable agent interaction are known as *connectors*, and a constellation of nodes and connectors is classified as a *network.* Connectivity is the key to networks and network design, as demonstrated for example, by networks of roads, a telecommunication network, or a neural network.

Among the eight ecological design criteria for MPA networks identified by the IUCN is that of *maximum connectivity*, which requires network designers to "maximize and enhance the linkages between individual MPAs, groups of MPAs within a given eco-region, and networks in the same and/or different regions" (IUCN 2007, 5).[77] In a similar vein, the UNGA report noted above refers to "ecological corridors" and most, if not all the literature advocating MPA networks emphasises the need for 'linkages' between MPAs. The emphasis on connectivity in the marine environment as integral to the success of oceans biodiversity protection is problematic on a number of counts.

The primary challenge is that of connectivity and corridors in marine protected area networks. Simberloff et al (1992), in their analysis of connectivity and corridors between terrestrial reserves, note that while they are applauded in theory, there is a disjunct between theory and empirical evidence. The same disjunct is even more pronounced in

[77] The eight ecological criteria identified by the IUCN are representativeness, replication, viability, precautionary design, permanence, maximum connectivity, resilience, and size and shape (IUCN 2007, 4-5).

marine environments. For instance, Laffoley, in his explanation of the criticality of MPA networks, uses larvae as a “common example” of species from one MPA supporting populations “of one or more species within other MPAs” (2006, 7). Larvae, however, are not a good example of the type of linear behaviour used by the high seas epistemic community to support the establishment of MPA networks. Leis notes that hard data on larvae dispersal distances is rare, and that dispersal of relevance for genetic/evolutionary connectivity is likely to be over far greater distances than for demographic/ecological connectivity (2002, 2006 in Leis 2006). Leis’ research reveals that it is inappropriate to assume that the larvae of fish and decapod[78] crustaceans are “passive particles whose dispersal can be understood as a purely physical process applied over the pelagic larval duration” (2006, 5). Larvae ‘behave’ and this greatly influences dispersal outcomes.

Other larvae behavioural variables include location, because of site-specific differences in hydrography and the interaction of behaviour of larvae with hydrography over small and large scales, and seasonal oceanographic variations which in turn impact on temperature-dependent rates of development and physiology in the cold-blooded organisms that dominate marine communities (Leis 2006, 5). The result of Leis research indicates that “no single inter-reserve spacing will be suitable for all MPA networks, and one that is suitable from an ecological point of view will probably differ from one suitable from an evolutionary point of view” (Leis 2006, 5). Essentially, what is suitable for one species in an MPA network would be unlikely to suit another. This implies that network design would have to be based on the movements of a single, rather than multiple species, bringing into question the ‘fit’ of this approach with MPA development based on the principles (if not the practice) of ecosystem-based management.

Different species use seascapes[79] differently and on different scales, and even if the necessary data existed, it would be impossible to reconcile seascape connectivity with habitat connectivity for more than a handful of species at best (Haddad et al 2003).

[78] *Decapoda* are an order of crustaceans with five pairs of walking legs, including shrimps, crabs and lobsters (Concise Oxford Dictionary).

[79] Haddad et al researched corridor use of terrestrial species and thus used the term ‘landscape’ instead of ‘seascape’, however, their observations apply equally to the behaviours of marine taxa.

Further, optimal management for one species may have the opposite effect for other species, as key ecological and behavioural data (for example, dispersal patterns and optimal habitat types) is rarely available, and the use of gross averages over significant areas may have adverse consequences and result in potentially far reaching errors (Harris and Scheck 1991; Bouwma et al 2004). Boitani et al (2007, 1418) use the example of wolves which are known to disperse from only a few to thousands of kilometres, meaning any gross average value would be of limited use in determining species mass, health or the benefits of maintaining species-specific transit routes. Some marine species follow direct, repetitive and therefore predictable migratory routes, whales being a high profile example, however, creating networks of MPA networks based on the migratory route of a particular whale species (each species being idiosyncratic in its behaviour) means these networks would be created primarily *for* a particular whale species, that is, single, rather than multiple, species protection.

Boitani et al conclude that the theory behind corridors/connectivity “does not extend to a body of practical indications on how to implement them to ensure their functionality” (2007, 1418). How *would* the shape, width and content of MPA networks be determined? As Boitani et al note, it would be necessary to provide evidence that demonstrates that the entire network structure – protected or core areas, corridors and perhaps buffer areas – would have an effect on some biodiversity value such as richness or species density “in the presence of many confounding variables and in a continuously changing matrix” (2007, 1419). Despite the existence of 150 landscape or regional terrestrial ecological networks around the world, not one has been assessed to measure efficacy of connectivity and increasing biodiversity conservation (Bennet 2004), not least because there are no explicit quantitative objectives that ecological networks can be tested against and because networks are almost impossible to evaluate (Boitani et al 2007, 1418). Boitani et al also note that focusing political energies and economic resources on the creation of ecological networks deflects attention from more effective alternatives (2007, 1419).

Diversity

Diversity is integral to the success or otherwise of high seas MPAs, especially when one recalls that in *cas*, diversity is the upshot of progressive adaptations and is integral to the evolutionary process that underpins the survival of agents and the complex adaptive system itself. As Holland reminds us, diversity in *cas* is neither random nor accidental – the persistence of any agent: "...depends on the context provided by other agents" (1995, 27). Because the primary tag has achieved primacy in international fora addressing high seas MPAs, the context provided by other agents serves to reinforce its lofty status. As we have seen, the high seas epistemic community has been highly influential in large-scale discussions on MPAs by repeatedly advocating its primary tag and a fixed set of concepts and principles aimed at achieving its overarching goal. While some agents within the global oceans *cas* have questioned the need for high seas MPAs and debated the utility of various instruments in achieving them, the tag of *a global representative system of MPA networks by 2012* has, and continues to be, at the forefront of discussions pertaining to the creation of MPAs in areas beyond national jurisdiction. While the concept does not have universal support, meeting records and the body of associated literature indicate its acceptance among the majority of participants in oceans governance and conservation fora.

Diversity is realised when agents disperse and create fresh opportunities for new interactions, thereby creating opportunities for new niches which can be exploited though the modifications of other agents. A peripheral but nevertheless important characteristic of *cas* as identified by Holland (1995, 27) is that of perpetual novelty, where new interactions create new niches so that the system can sustain itself. As the *cas* literature emphasises, a system is never truly stable and nor should it be; evolution and regeneration go hand in hand and are realised through a multitude of tipping points, accidents of history, and thresholds. As discussed in Chapter Three, the popular steady state/equilibrium paradigm is embraced by those who believe that a 'state of balance' is desirable for both nature and human society and therefore a worthy aspiration. Just how one recognises when this state of equilibrium is achieved has not been elaborated; it remains a utopian ideal to those advocating its achievement, with advocates hard pressed to describe what it might be.

There seems to be little if any room for diversity in an epistemic community that advocates fixed, finite and immutable goals of the ilk of a global representative system of MPAs by 2012, and when there is no room for diversification in the primary tag itself. Diversity serves a distinct and critical purpose in *cas* evolution and progression; as each adaptation takes place, it generates new interactions and the creation of new niches, all of which contributes to the perpetual novelty, or non-linearity, of a complex adaptive system. At the risk of labouring the point, without the capacity to diversify, adapt and 'fit', an agent soon finds itself withering on the vine, a victim of its failure to be the fittest and therefore survive.

Internal models and building blocks

All agents have internal models, both tacit and overt, which inform their views of the world. Agents process the contents of flows of information, material, knowledge or experience in order to assess their effect on the system itself, as input for development of internal models, and to construct strategies for future problems and challenges. Tags that attract like-minded or curious agents to aggregate can evolve into building blocks which in turn contribute to the construction of internal models. Arguably, this is what may evolve through repeated use of the primary tag of *a global representative system of MPA networks by 2012*, although the temporal goal may constrain its evolution from tag to building block.

Other dominant terms in environmental discourse such as *sustainable use*, *ecosystem-based management*, *ecosystem approach, adaptive management* and *the precautionary principle* commenced their terminological ascendancy as tags. The passage of time and repetition, however, has seen them evolve into building blocks embedded in the internal models of agents focused on improving the ecological health of the planet. Building blocks, in the context of *cas*, are mechanisms that "serve to impose regularity on a complex world" (Holland 1995, 37). The mixture of tags and building blocks discussed in this chapter are intended to impose a preferred order within the global oceans governance *cas*. The primary tag of *a global representative system of MPAs by 2012* is nurtured by the high seas epistemic community as a key element of the formula for effective conservation of oceans biodiversity in areas beyond national jurisdiction. If not for its temporal limitations, it might too have evolved into a building block for those seeking the ultimate goal for the protection of oceans biodiversity.

In the eyes of the high seas epistemic community the prognosis for ocean health is not promising – serial depletion of commercial fishstocks; deep water corals and sponge beds being 'clear felled' by bottom trawling; the multiple impacts of climate change on the marine environment; elimination of apex predators from the marine food web; technological advances moving us closer to marine mining at incredible depths; and the promise of biotechnological bonanzas courtesy of deep ocean organisms. It is little wonder that the high seas epistemic community finds comfort in its collection of tags and building blocks, and remains committed to the belief that this assortment of goals and solutions will contribute significantly to a desired future steady state of ecologically healthy, productive and sustainable ocean systems.

As well as being the basis for the composition of strategies, building blocks also enable agents to decompose complex processes and systems into smaller parts which can then be combined and recombined repeatedly and at diverse levels (Ostrom 1999, 523). The process of decomposition helps the agent identify the particular set of rules required to rectify a situation. The high seas epistemic community sees significant problems with the current status of oceans governance and its efficacy in protecting oceans biological diversity, therefore it has a set of building blocks and tags with which to construct an appropriate course of action to rectify a situation and achieve a desired end state.

The primary driver behind the high seas epistemic community's call for spatial management in areas beyond national jurisdiction is that of fisheries control. The community has significant concerns about the impacts of bottom trawling on vulnerable marine ecosystems, and the impact of overfishing on oceans biodiversity. Le Quesne describes the simple internal model (reasoning) of MPA proponents in their mission to increase the spatial management of the world's oceans and seas and control what is perceived to be the biggest threat to oceans biodiversity:

> The desire to establish marine protected areas for conservation and fisheries management is often partially based on the perception that there is currently a fisheries crisis in the world's oceans. Current fisheries management has failed, so we need new tools. MPAs are a new tool, and when optimal MPAs are modelled, they regularly predict an increase in yield and biomass compared with the *status quo* (2008, 132).

Although this 'linear logic' is antithetical to the *cas* concept and as such, difficult to reconcile, its presence in the global oceans *cas* is evident in the high seas epistemic community's primary tag and in Le Quesne's depiction of MPA proponents' cause-and-effect approach underpinning calls for MPAs. The 'fitness' of this linear logic in the global oceans *cas* will be tested once 2012 has come and gone and the high seas epistemic community needs to formulate a fresh approach toward the creation of high seas MPAs. As Simon (1962, 472-73) reminds us, if the resulting actions of an agent's behaviour can anticipate future consequences that are useful, the agent has an effective internal model; if not, it has an ineffective one. If the agent can find an appropriate way of connecting future credit to current actions, evolution will favour effective internal models and eradicate those that prove ineffective.

The foundation upon which the high seas epistemic community's building blocks rest, like that of most if not all major non-government environment organisations, is that of moral suasion. Because of a perceived 'environmental crisis', the international community 'must' act before its too late, 'must' exercise the precautionary principle, and 'should' implement measures to protect ocean biodiversity as soon as possible, because "[g]iven the fragility of the environment, we simply do not have the luxury of time for the High Seas" (Laffoley 2005, 9). The moral solution to this crisis is, according to Roberts, straightforward:

> We need to establish large-scale networks of marine reserves, we need to slash fishing effort for many species, we need to ban the most destructive fishing gears, we must adopt the best available technologies for reducing by-catch and we must dismantle the risk-prone decision-making structures that leave the final

> decisions on how much to catch in the hands of politicians and industries (Roberts, in Young 2008, 34).

Alternatives to the “risk-prone decision-making structures” dominated by “politicians and industries” are not forthcoming, at least in the article the above quote was lifted from, as Roberts does not tender more viable options apart from wresting responsibility away from those whom he perceives as failing in their duty to protect oceans biodiversity.

Semantic Deconstruction of the primary tag of a global representative system of marine protected areas by 2012

Key figures in the high seas epistemic community believe that high seas MPAs will initially protect two classes of high seas features: geomorphic features such as seamounts, reefs and hydrothermal vents; and variable pelagic features such as gyres, upwellings and convergences, the latter having been identified a considerable challenge by one of the key figures in the high seas epistemic community (Norse 2005).

Deconstruction of the epistemic community’s primary tag of *a global representative system of MPAs by 2012* raises a number of conceptual challenges. What constitutes a *global representative system of MPAs*? Is success measured by the percentage of area of seabed and/or water column afforded protection through spatial demarcation? Is it to be a quantifiable system, determined by a specific number of MPAs within and beyond national jurisdiction? How will we know when *a global representative system* has been achieved? The 2003 WPC, for example, recommended that a minimum of 20-30 per cent of all marine habitats be included in networks of marine reserves (World Parks Congress 2003, Recommendation 22). Another study undertaken by members of the high seas epistemic community concluded that between 20 and 50 per cent of the sea must be protected to ensure conservation of ocean species (Gell and Roberts 2003). A recent Greenpeace report expressed a goal of protecting 40 per cent of all habitats in the high seas (Roberts, Mason and Hawkins 2008). It seems that attempting to quantify the area of ocean required to complete a global representative system is reminiscent of the conundrum: how long is a piece of string? When considering issues around networking and its fit with *representivity*, our conundrum becomes: how long are many pieces of string? While these figures are no doubt estimates informed by the precautionary principle, we should be wary of the traps that unrealistic targets pose in the contexts of both conservation and diplomatic interests. When a primary tag such as *global representative system of MPAs by 2012* lacks any quantitative detail, it can inadvertently set a trap to catch itself.

Thirdly, the term *representative* is problematic. Representative habitats are described "by ecosystem level structures - primarily enduring geophysical features - and recurrent processes" (Roff and Evans 2002). The properties of a representative habitat can be hierarchically ranked and mapped to include the entire environment within a region (Roff and Evans 2002). A representative MPA, therefore, is a demarcated area of a typical habitat that is afforded some degree of protection from human activities in order to gauge physical and/or biological processes which can then be compared with the unprotected portion of the habitat, or with similar or same habitats elsewhere. As little more than 0.0001 per cent of deep-ocean environs have been biologically investigated, and relatively little is known about the spread of deep ocean geophysical and geomorphic features, it is difficult to know how representative the high seas component of a global representative MPA system might be. Although seamounts, for example, are scattered across the world's oceans, their fauna and flora vary markedly from location to location, therefore a seamount MPA or even a chain of seamounts is not representative of the world's population of seamounts; instead it represents protection of a *distinct* seamount or seamount chain.

The epistemic community has specified a number of high seas geomorphic features that they believe warrant MPA status, including Rainbow and Logatchev hydrothermal vent fields, the Tasman seamounts, waters over the Grand Meteor seamount, the Emperor Seamount Chain, Gakkel Ridge in the Arctic Ocean, the Charlie Gibbs Fracture Zone in the North East Atlantic, the Saya de Malha Banks in the Indian Ocean, the Ross Sea, the East Pacific Rise Hydrothermal Vents, Lord How Rise in the Pacific Ocean and the sensitive deep-water habitats of the Grand Banks (IUCN 2003a; IUCN 2008b). The paradox is that these areas fit neatly into the category of *distinctive* rather than *representative* habitats. Distinctive habitats are atypical of surroundings and defined by anomalous oceanographic and biological processes and/or geomorphic structures which distinguish them from the surrounding area (Roff and Evans 2002). Taking the various kinds of anomalies, processes, characteristics and/or focal species into account, Roff and Evans have classified upwellings, hydrothermal vents, coral reefs and beds, and seamounts as *distinctive* habitats (Roff and Evans 2002). Indeed the 2001 Vilm Expert Workshop, which was attended by several key agents in the high seas epistemic community, identified *distinct ecosystems* as prime candidates for high seas MPAs, and yet the use of the term *representative* has persisted in the community's primary tag.

Representivity, as defined by the SBSTTA and accepted by the Conference of Parties to the CBD, is:

> ...captured in a network when it consists of areas representing the different biogeographical subdivisions of the global oceans and regional seas that reasonably reflect the full range of ecosystems, including the biotic and habitat diversity of those marine ecosystems (UNEP/CBD/COP/DEC/IX/20).

Curiously, however, another required network property or component identified as critical to establishing representative networks of MPAs in open ocean waters and deep sea habitats is ecologically and biologically significant areas based on, inter alia, "uniqueness or rarity" (UNEP/CBD/COP/DEC/IX/20 Annex II). This rather odd paradox (representative vis-á-vis uniqueness or rarity) only serves to complicate the issue of what constitutes a 'representative system' for the high seas epistemic community.

The 2012 temporal goal also invites closer scrutiny. The epistemic community acknowledges that the discovery of new scientific and social knowledge is an ongoing process, and as such marine management needs to be both dynamic and adaptive in order to be effective. This leads one to query the value of articulating 2012 as the temporal goal for a global system when there are so many challenges to its achievement, including a dearth of knowledge about deep sea environments. Indeed, articulating temporal goals in any socio-ecological management context can be considered problematic because timeframes define endpoints, whereas an ideal scenario would be that of an organic and dynamic process with policies updated as new knowledge and experience comes to hand, after all, most of the discourse underpinning environmental policy emphasises the need for an adaptive and evolutionary process rather than being temporally finite. Identifying a temporal goal might well defeat the principle of sustainability that underpins a global representative system of MPAs. As remote as the notion seems, were such a system to be achieved by 2012, (or indeed any other time target), it might result in the impression that all that needs to be done has been done. The sense of complacency that comes with achievement may prove very difficult to dislodge should circumstances indicate that nation-states need to do yet more to protect the marine environment.

According to data released by the *Sea Around Us* Project, at the current rate of global MPA designation the most optimistic date for achieving *a global representative system of MPAs* is 2085. This is a best case scenario based on the World Parks Congress target of protecting 20 to 30 per cent of each marine habitat as no-take areas (Woods 2005, 1). The projections were based on growth of global MPA coverage to date and built on a linear regression of cumulative MPA area since 1979, therefore as initiatives to increase protection are implemented in national waters and the high seas, the rate of increase in protection may result in earlier achievement of a *global representative system of MPAs* (Woods 2005, 1), even though the challenge is to define what constitutes such a system.

Experts have cautioned against the adoption of ambitious and short MPA timeframes and the dangers of rewarding decision makers for picking “low hanging fruit” by selecting politically rather than ecologically significant sites for the sake of expediency (Agardy 2005, 2). The scale and complexity of identifying, designating, managing, monitoring and policing *a global representative system of MPAs* will also require policy development and planning over many decades (Kenchington 2005, 2). Kenchington is of the view that when marine habitat protection is regarded simply as a conservation use, it polarises stakeholders (no-take MPAs versus fisheries), thereby undermining the pursuit of conservation initiatives together with ecologically sustainable use of marine resources. He highlights the need for proponents of the *global representative system of MPAs by 2012* tag to take a more balanced approach to oceans biodiversity management by appreciating the protection afforded by other initiatives such as area closures to certain fishing gear types while remaining open to more benign extractive methods. Kenchington notes that by recognising other management regimes beyond no-take MPAs, habitats can be protected effectively. Further, our conception of MPAs will broaden, as will the public's appreciation for the true extent of global marine conservation efforts. As Kenchington notes:

> Conservation is more likely to be achieved through marine ecosystem and resource management organisations providing multi-objective policy, planning, and management than through continuing sectoral confrontations between conservation and fisheries (2005, 2).

The high seas epistemic community has acknowledged the rocky terrain of international law-making and the need to take a pragmatic approach toward realisation of a global representative system. For instance, the 2003 NGO Experts Workshop on High Seas Marine Protected Areas held in Malaga developed:

> ...practical steps toward the establishment of one or more [high seas] MPAs as 'test cases'…to build experience with the practicalities of design, implementation and enforcement, as well as to promote cooperation and coordination among relevant regional and international organizations" (IUCN 2003a).

Practical proposals identified at the Malaga Workshop included voluntary measures amongst like-minded nations and soft law agreements in addition to the high seas epistemic community's usual international legal and institutional preferences. A number of Action Plans were also drafted to address the specific potential high seas MPA sites identified at the Malaga Workshop (IUCN 2003a). However, like high seas conservation fora held before and since the Malaga Workshop, the overwhelming preference remains for MPAs beyond national jurisdiction to be part of global vision legitimised in legally binding text. Evidence suggests that international acceptance of the high seas MPAs concept may benefit from a less ambitious and more politically cautious 'micro-action' approach such as an MPA prototype, rather than embedding the concept within the global representative system macro-goal, and this issue is addressed in more detail in Chapter Seven.

While the marine epistemic community couples its argument for the conservation of marine biodiversity with the need for an ecosystem-based approach, it also acknowledges the geopolitical constraints established by the LOSC. As noted in the summaries of workshops and conferences in Chapters Four and Five, the CBD has the capacity to extend its mandate to certain types of activities occurring in areas beyond national jurisdiction. Nevertheless, a cursory glance at the meeting reports reveals that discussions on high seas biodiversity protection in the AHTEG, SBSTTA and COP meetings have been overwhelmingly focused on detailed initiatives at national and regional levels, while high seas biodiversity issues are expressed in broad, generic, principled statements and offerings of sage advice with little guidance toward a practical strategy for establishing high seas MPAs. There are exceptions – the identification of high seas research areas and pilot/candidate sites, Action Plans, and the Steps to Designation crafted at, and following, the 2003 Malaga Workshop are excellent examples of pragmatism which could be pursued by fora such as the UNGA, the SBSTTA, AHTEG, and Conference of Parties to the CBD. It is also important to keep in mind that the Malaga Workshop provided a forum specifically for the high seas epistemic community whereas many of the fora described above have a broader and more diverse membership and are usually required to address a multiplicity of oceans governance issues in a very short timeframe.

As noted by Roff and Evans, a pragmatic strategy for marine conservation would be to capture some defined proportion of each representative habitat type together with known distinctive habitat types (2002, 637) so that the relationships between distinctive and representative habitats and species diversity can be examined (2002, 635). A representative system of deep ocean habitat MPAs (that is, beyond continental shelves) seems virtually impossible in the near future, not least because of lack of political will, more pressing issues on the international issue agenda, and the paucity of scientific data and knowledge about the deep sea environment. Indeed, these challenges prompt one to question how members of the high seas epistemic community can arrive at the following conclusion without any scientific evidence to support it:

> Representative networks of MPAs – those that contain examples of all habitats and ecological communities of a given area – also provide a cost effective means

> of safeguarding large-scale processes while delivering local benefits. Networks can also help reduce the degradation of coastal and marine habitats, slow the loss of endangered marine species, and restore depleted fisheries (IUCN 2007, 3).

The utility of existing environmental laws and conventions for the creation of high seas marine protected areas, and opportunities to create a new high seas MPA regime

A common thread running through high seas MPA fora is that of the utility of existing international laws and instruments to hasten the establishment of high seas MPAs, or the alternative of creating a 'stand-alone' high seas MPA instrument. As noted by Morgera (2007, 9), debate continues on whether the "insufficient" protection of marine biodiversity beyond areas of national jurisdiction is due to an "implementation gap" – poor implementation of existing agreements and mechanisms – or a "governance gap", meaning there is a need for additional international instruments and regimes to manage and regulate currently unregulated activities.

The EU is of the view that there is a governance gap in the management of areas beyond national jurisdiction and as such supports an implementing agreement to the LOSC. It has called for "the protection and preservation of the marine environment which will provide for the conservation and management of marine biological diversity in areas beyond national jurisdiction, including the establishment ....of marine protected areas" (EU Presidency Statement 2006). Be it implementation or governance gap, high seas MPA proponents see international law and conference diplomacy as providing the leverage points that will contribute to large, directed changes in the global oceans governance *cas*.

The juridical theme has been revisited at every conference and workshop described above, and existing oceans-related instruments and institutions identified as having utility for high seas MPAs thus far include:

- 1982 Law of the Sea Convention (the overarching oceans governance framework);
- Convention on Biological Diversity (biodiversity);

- International Seabed Authority (minerals);
- International Oceanographic Commission (scientific research);
- International Maritime Organisation (shipping);
- Fish Stocks Agreement (living marine resources);
- Convention on Migratory Species (migratory living marine resources);
- United Nations General Assembly (comprehensive global action); and
- The World Heritage Convention

Environmental NGOs tend to present a traditional and stylised view of international law when promoting or advocating new regimes for environmental protection, believing that: (i) countries accept an international accord when their governments have concluded that it is in their best interests; (ii) that as such, countries will comply with the accord; and (iii) non-compliance means sanctions will be used as punishment, thereby deterring other countries and encouraging compliance (Jacobson and Brown Weiss 1998). The high seas epistemic community seems to be no exception to this view. In practice this stylised formula rarely occurs, with evidence suggesting that compliance with international environmental accords is haphazard and uneven, not least because there is often a disjunct between a country's intention to comply and its capacity to do so (Jacobson and Brown Weiss 1998). When promoting the creation of new regimes for the protection of biodiversity, environmental NGOs do not acknowledge that there is very little legal and social accountability in the international system (Allott 1993, 62). This stands in stark contrast to the criticism that environmental NGOs direct toward countries and existing international environmental regimes when they believe there is a failure in the execution of eco-ethical obligations.

The import of international oceans-related laws cannot be denied; their passage has conjured up a sensitive mixture of rights and responsibilities in areas beyond national jurisdiction and those involved in oceans governance negotiations are cognisant of these sensitivities. Nevertheless, discussion and debate about high seas MPAs is in danger of flying in ever-diminishing circles should members of the global oceans governance network continue to labour over the utility of extant international conventions and instruments without devoting more time and resources investigating, and investing more faith in, alternative marine environmental protection options such as voluntary or non-binding agreements and codes of conduct.

The net effects of large scale behavioural changes already agreed and implemented by resource appropriators also need to be taken into consideration. There is more than a grain of truth in Allott's observation that the international community's "obsession with texts is a clear sign of the impoverishment of the international system as a political system and of the rudimentary nature of the international system as a democracy", and that "the adoption of texts … through diplomatic processes has come to rival war as the leading form of international obsessional behaviour" (1993, 62). The high seas epistemic community may be making progress to improve the protection of oceans biodiversity behind the scenes, but examination of fora proceedings on the public record reveal that there has been little movement beyond identifying those instruments which might potentially provide legal ground for the establishment of high seas MPAs. While voluntary agreements are occasionally acknowledged (although rarely examined in any detail) by the high seas epistemic community, there is a strong preference for formal, binding instruments to control and manage human activities on the high seas.

As detailed in Chapter Five, there are numerous arguments for and against using existing international regimes as root stock for high seas MPAs. For instance, although the competency of the CBD does not extend to the components of biodiversity beyond national jurisdiction *per se*, there are those who, in arguing in favour of the competence of the CBD in areas beyond national jurisdiction, interpret the exception in Convention Article 22 (1)[80] as supporting the primacy of the CBD over the LOSC when serious damage to biological diversity arises as result of the exercising of rights and obligations under the LOSC (Morgera 2007, 5). The common interpretation, according to Morgera, is that the LOSC provides the broad legal framework for all activities on or in the ocean,

[80] Convention on Biological Diversity Article 22 (1): "The provisions of this Convention shall not affect the rights and obligations of any Contracting Party deriving from any existing international agreement, except where the exercise of those rights and obligations would cause a serious damage or threat to biological diversity."

while the CBD has limited legitimacy in relation to the protection and sustainable use of marine biodiversity in areas beyond national jurisdiction (Morgera 2007, 5).

A popular proposal embedded in the discursive behavioural patterns of the high seas epistemic community is for a high seas MPA implementing agreement to be added to the 1982 LOSC. Theoretically, this is possible as the delegations at UNCLOS III made provision for amendment of the Convention through Articles 312[81], 313[82], and 314[83] (Johnston 2003, 140). The LOSC has already been 'revised' through the introduction of two implementation agreements: the 1994 Agreement Relating to the Implementation of Part XI of the Convention; and the 1995 FSA).

Johnston argued that those who view the LOSC as the "charter" for the marine environment are usually in favour of: "...a conscientious revision designed to incorporate environmental concepts and principles that have evolved since the conclusion of UNCLOS III in 1982" (2003, 145-146). He noted that 'revisionism' motivated by environmental concerns is usually done so for ethical rather than technical reasons (2003, 146). As noted in Chapter Five, the evolution of environmental principles underpinned by moral or ethical suasion was evident in the Greenpeace publication: "Black Holes in Deep Ocean Space: Closing the Legal Voids in High Seas Biodiversity Protection" (2005). Greenpeace mounted an impassioned argument for an implementing agreement to the LOSC premised on a litany of holistic principles for deep oceans governance, coupled with calls for the high seas to be "off limits to extractive and

[81] Under Article 312, any one party "[a]fter the expiry of a period of ten years from the date of entry into force of the instrument may propose specific amendments other than those relating to activities in the Area and request through the Secretary General of the United Nations the convening of a conference to consider the proposed amendments (Johnston 2003, 140).
[82] Article 313 prescribes as an alternative, a "simplified procedure" whereby any party may request that the UN Secretary General circulate to all other parties a proposal for amendment other than an amendment relating to activities in the Area. If no objections are raised within 12 months of the circulation of the amendment, it is considered adopted. If objections are raised, the proposed amendment is considered rejected (Johnston 2003, 140).
[83] Article 314 created a special procedure for amendment of provision relating exclusively to activities in the Area. Open to any party to the Convention, this procedure requires written communication to the Secretary General of the International Seabed Authority and the proposal is subject to approval by the Assembly following its approval by the Council (Johnston 2003, 140-141).

disposal activities unless and until it can be shown that these activities do not cause harm to the surrounding environment" (2005,3).

Greenpeace is of the view that a third implementing agreement to the LOSC, modelled on the 1995 FSA, will provide a comprehensive, legally binding agreement to facilitate, inter alia, a "global network of high seas marine reserves" and establish a centralised, monitoring, control and enforcement agency which would be the "Interpol for the oceans" (2005, 7). As noted by Johnston (2002, 9), however, the primary danger in contemporary global diplomacy is the propensity to generate 'over-expectations' through grand and seemingly successful negotiations, with idealised goals such as ecosystem-based or integrated oceans management setting an exciting agenda for diplomacy. Indeed, selling "such an ambitious, and potentially sophisticated goal is a stirring challenge to the art of salesmanship" (Johnston 2002, 9). Those responsible for executing those ambitious, broadly designed projects at the domestic level, however, find it increasingly difficult to demonstrate any tangible results within the usually short time frame that is specified, an example being the goal *of a global representative system of MPAs by 2012* and the failure to achieve this based on protection of between 20 and 30 per cent of the world's ocean habitats. Although the details of what constitutes such a system are hazy, it is clear that it is not going to be achieved by 2012.

Hinds (2003) explains the issues behind the 'implementation gap', in particular, the policy making architecture and related capacity of United Nations specialised agencies, their global approach in addressing marine issues, and the strong culture of "bureaucratic politics" inherent in each. Each UN specialised agency is sovereign in its own sector, and each has its own secretariat, budget, constitution, membership and domain. The policy outcomes of each of these UN 'silos' give rise to numerous conventions, protocols, and action plans, ocean use, management and development protocols, shipping controls, pollution controls, and conservation of marine living resources that member states struggle to ratify through domestic legislation when multiple issues are jostling for legislative attention, resulting in an "implementation backlog" (Hinds 2003, 351). The two fundamental reasons behind the implementation gap not being filled are, according to Hinds:

1. The inability of UN system agencies to fully implement t resolutions approved by their respective governing bodies; and
2. The inability of sovereign states, in particular developing countries, to enact national legislation that is linked to UN resolutions and international conventions and to provide resources for their enforcement (2003, 353).

At the state level, the implementation gap can be linked to four key issues: (i) political will; (ii) economic development agenda setting; (iii) scientific, technical and institutional capacity; and (iv) financial resources (Hinds 2003, 354). Political will is of particular interest. It peaks during the time of signing international agreements, and at UN meetings where resolutions are debated and approved in plenary, however, it ebbs at national level when the state fails to transform its tentative international obligations into national policy or legislation, and when it comes to providing funds for the implementation and enforcement of programmes (Hinds 2003, 354).

Kellow, in his analysis of the efficacy of the Kyoto Protocol in addressing climate change effectively, notes the perverse outcomes that arise when the international community takes a global approach to what is perceived as global problems, thereby involving the maximum number of parties in negotiation and instrument design (2006):

> The problems of such processes are well-enough documented: negotiations can proceed (like a convoy) only at the speed of the slowest boat; this can only be overcome by resorting to lowest common denominator approaches, double standard approaches to excuse developing countries, creative ambiguity and iterative functionalism (Boehmer-Christiansen and Kellow 2002; Sand 1990 in Kellow 2006, 290).

International organisation specialists emphasise the intrinsic limitations of large-scale structures at global or macro-regional levels – the structural, political, hierarchical and financial restrictions inherent in all large-scale state government bureaucracies are in turn constrained by the inter-cultural, strategic and ideological limitations that operate at the international community level. Even in the best of circumstances where an international organisation functions with minimal friction, the "politics of conference diplomacy at the global or macro-regional level is rarely simple" (Johnston 2002, 6).

Examples of arguments regarding high seas MPAs are reflected in the details on the eighth and ninth meetings of the SBSTTA described in Chapter Five, with most of the contentious issues unlikely to be resolved in the foreseeable future, (if ever). Although there is no tangible evidence to support the following assertion, perhaps the reason why some of the more dominant nation-states subscribe to the primary tag of a *global representative system of MPAs by 2012* and the need for the principles behind it to be cemented in a legally binding instrument is that such an ambitious and essentially contestable goal enables them to express concern for the protection of oceans biodiversity and demonstrate a willingness to 'do something'. With the protection of oceans biodiversity underpinned by such lofty ambitions, states remain safe in the knowledge that the difficulties of negotiating a legally binding instrument will ensure a significant gap between rhetoric and realisation, and provide ample time to focus on more pressing issues. As Johnston notes, the outcomes of global conference diplomacy are "essentially accomplishments in the language of commitment" (2002, 8). In many countries, the political leadership is of the view that it is enough to be seen to accede to the objectives of international environmental law through participation, signature, and even the occasional ratification, but as the body of these instruments expands, it becomes increasingly difficult to embed international priorities in national strategies. This poses the risk that the political credibility of international environmental law will diminish in the eyes of nation-state decision makers and economically struggling constituents, even though lip service is afforded to "the legitimacy of environmental goals at the level of idealism or rhetoric" (Johnston and VanderZwaag 2000, 147).

This leads us back to the concept of topology in the hierarchical organisation of *cas*. The patterns arising out of short run behaviours (lateral interactions) permeate broader system scales at a much slower rate and the rate of vertical interaction between levels or subsystems progresses more weakly and slowly so intuitively, the greater the scale, the lower the frequency. This goes some way toward explaining why international environmental law making moves at a glacial pace – the drivers are often eco-ethically ideological, the goals usually over-ambitious, the agents spend an inordinate amount of time adapting to other agents in order to achieve consensus on an outcome that bears only a passing resemblance to the original concept or proposition, and signatory states soon find their attention directed to more pressing or urgent domestic issues that deflect from the process of ratification. The upshot is that the proponents, more often than not deeply disappointed in the resulting instrument, recommence their campaign to elevate the issue once more to the international agenda. It stand to reason that each time this occurs, the rates of interaction between agents and between levels are weaker and less frequent because in the eyes of the parties to the final agreement, the issue has already been addressed, agreement has been reached, and they are free to move on to other considerations.

It is hardly surprising that oceans governance discourse, especially the high seas component, displays a predilection for finding or manufacturing the appropriate instrument, mechanism or convention that defines or describes means of social control; after all, an important part of the dominant ideology of human societies throughout modern history "has been devoted to structures of ideas concerning the distribution of social and individual control over things" (Allott 1993, 53). Allott's observation concerning the international community's obsession with texts also applies to those calling for new high seas MPA-specific and formally binding instruments to be negotiated. As Johnston and VanderZwaag note, if the proliferation of environmental instruments continues at the current rate, they may reach the point of: "...diminishing returns, where the currency of expectation will be debased by the frequency of reference to the goals which they promote" (2000, 146).

As noted in Chapter Five, the complexity and challenges of negotiating yet another global instrument or legal framework for high seas MPAs were not lost on two significant Northern Hemisphere fishing nations. The Report of the First Meeting of the Ad Hoc Working Group on Protected Areas presented to the CBD's 8th Conference of the Parties included a statement from Norway, with the support of Iceland, responding to the need for a new legal framework for the establishment of high seas MPAs:

> We are not convinced...that there is a need to establish a new legal framework specifically pertaining to the establishment of high-seas marine protected areas. To negotiate amendments to existing international law would be time-consuming and difficult, and it would take valuable resources and focus away from implementing specific measures with practical results. Rather than focusing on the development of new instruments States should cooperate to utilize existing possibilities. Existing knowledge shows that the main threat to biodiversity in the oceans is unsustainable fishing practices, and the first priority must be to adjust these practices (UNEP/CBD/COP8/8, 23).

The 1982 LOSC has been identified in the conclusions and recommendations of numerous oceans governance fora summarised in Chapters Four and Five as the framework convention with the capacity to guide the establishment of high seas MPAs, although as we have seen, there has not been universal agreement on this issue. Neither *marine protected area* nor any similar terminology appear in the 1982 Convention, however there are a number of provisions that address protection and preservation of the environment.

The 1982 LOSC is a formally binding treaty, but the ties that bind are “loosely worded provisions” in need of more specific language “to qualify as obligatory and enforceable hard law” (Johnston 2002, 12-13). Indeed some scholars view the 1982 Convention as a concoction of hard and soft provisions, with environmental protection considered soft law, while jurisdictional and navigational provisions are ‘hard’ that is, legally binding (Hewison 1996, 32-35). Others interpret the LOSC as affording priority to the utilisation of marine resources at the expense of their protection (Platzöder 2001, 137). As Johnston suggests: “...international law has always been on the cusp between idealism, in one form or another, and a practical understanding of reality of one kind or another” (2002, 14). The high seas epistemic community, like many if not all international environmental non-government organisations, is motivated by eco-ethical idealism and belief in a traditional stylised view of international law on the one hand, while being disappointed with the efficacy of the global and regional instruments already in place on the other.

... and finally, the cost of a global representative system of MPAs

The full financial cost of MPAs includes funding for establishment, administration, employment, monitoring and enforcement. Balmford et al (2004) collected survey data on the financial requirements of 83 MPAs around the world, and on the basis of that data, estimated that a global MPA network covering 30 per cent of the world's oceans, including the high seas, would cost between $US5 billion and $US19 billion annually. Morling (2005, 29-30) states that while this may seem expensive, $US19 billion "is a mere 2% of annual global military expenditure and equivalent to the annual amount the world spends on cosmetics or pet food."

Intuitively, the key challenge arising out of Balmford et al's calculation and Morling's observation is that the global MPA 'maintenance' bill would be in addition to that already undertaken by states in terms of military expenditure. In a geopolitical environment of mounting inter-cultural tensions and financial instability, would states be prepared to bear these additional costs, even though at this stage the details of what constitutes a global representative system of MPAs are yet to be revealed? Preceding any agreement by countries to contribute to the significant global MPA maintenance bill would be the monumental costs associated with negotiating a global representative system in the first place.

Conclusion

Agardy et al's wise observations capture the critical issues behind this critique of the high seas epistemic community's high seas MPA discourse and its primary tag: "To create absolute and inflexible standards and targets that utilize a single approach pushes marine conservation into unnecessary and costly battles that cannot be afforded" (2003, 355). Further, they note that:

> ...currently fixating professional debate and resource allocation on addressing the issue of 'how much in total' without adequate answers to the questions of 'what' (definitional', 'for what' (objectives), 'for whom' (audience and social equity), 'how' (applying the appropriate mix of protection tools given operating conditions), and 'where' (more often than not there are options as to which areas might be protected) may be counter-productive to the global needs for increased

> marine protection and counter-intuitive to the scientific understanding that is needed (Agardy et al 2003, 364).

In order to identify the gaps between the idea of high seas marine protected areas and their realisation, this chapter has deconstructed and tested the primary tag of the high seas epistemic community through the lens of *cas* theory and with the assistance of Young's 2004 examination of how the operation of environmental regimes influences the growth and dissemination of knowledge.

The primary tag of the high seas epistemic community – *a global representative system of MPAs by 2012* – has attracted like-minded agents and provided context for the community in its mission to protect the biodiversity of oceans beyond national jurisdiction. This chapter has also demonstrated the numerous paradoxes, limitations and challenges inherent in employing a primary tag to drive the ideal of high seas MPAs and how, over time, the tag has moved from having a multiplier effect in relation to flows of information and attracting like minded agents, to that of recycling through repetition with little uptake of new agents and challenging ideas to reinvigorate debate.

The high seas epistemic community is an agent nested within the global oceans governance complex adaptive system. It has been instrumental in embedding the primary tag in discourses in international oceans biodiversity fora. As I have demonstrated, however, there is a paradox between the high seas epistemic community's championing of the primary tag with its fixed, finite and immutable goals, and the complex, adaptive and perpetually novel characteristics of the global oceans governance system within which it sits. Another paradox is evident in the high seas epistemic community's call for an implementing agreement to the LOSC or creation of a new global and legally binding instrument to legitimise high seas MPAs while simultaneously criticising or lamenting the ineffectiveness of existing instruments that have already been crafted with the intention of protecting or at least sustaining, oceans biodiversity. Environmental NGOs, the high seas epistemic community included, take a stylised traditional view of international law and yet at the same time deplore the existing “risk prone decision making structures that leave final decisions ... in the hands of politicians and industries” (Roberts, cited in Young 2008, 34).

The high seas epistemic community identifies a considerable gap between existing ocean management regimes for the high seas and an appropriate legal framework for the creation of successful high seas MPAs (Thiel and Koslow 2001; IUCN 2003a; WWF et al 2005). Because the ocean beyond national jurisdiction is an “open access common resource”, the community’s energies are devoted to encouraging “innovative legal thinking to ensure proper MPA designation, management and enforcement” (WWF et al 2005). Environmental non-government organisations maintain that high seas MPAs cannot be successfully created unless an “appropriate legal framework” is devised (WWF et al 2005).

Revision of international legal instruments constitutes a formidable task which may or may not realise the desired consequences. International laws, be they hard or soft, are more often than not the product of compromise diplomacy and, as demonstrated during the difficult and convoluted negotiations that eventually led to the LOSC, the topography of compromise-seeking can prove particularly arduous and challenging (Johnston 2003). The more parties involved, the more difficult it is to reach agreement. Moreover, the latter tends to be realised through lowest common-denominator outcomes that may be a mere shadow of the initial corpus of solutions proposed to address the environmental problem or issue on the agenda. The epistemic community’s efforts to change the tenor of existing instruments may also result in unintended consequences. Parties may, for instance, seize the opportunity to retract rather than strengthen their environmental obligations, or they may perceive little if any merit or utility in revising existing agreements, seeing them as adequate in their present form and preferring to maintain the status quo.

Negotiating a new legally binding regime is also wrought with challenges. Some states have already expressed concerns that establishing MPAs in areas beyond national jurisdiction will impinge on the high seas freedoms articulated in the LOSC. In light of the difficulties surrounding negotiation of Part XI of the 1982 LOSC and the subsequent 1994 Implementing Agreement, the most likely scenario regarding the legal status of high seas MPAs is that negotiating a binding global high seas MPA instrument will prove equally, perhaps even more gruelling than before.

International environmental agreements negotiated at numerous global fora have produced a manifesto of broad-spectrum social and ecological principles and motherhood statements that reflect the profound normative changes of the past few decades. While these principles and statements provide the foundations upon which to build oceans governance and marine management strategies, I have also argued that they have evolved into a language of idealism that has subsumed more pragmatic methodologies. As Johnston notes:

> … outcomes of global conference diplomacy are essentially accomplishments in the language of commitment. In a field such as ocean management, global agreement on an impressive text often seems significant only if it is accompanied by a shared, genuine and lasting commitment to participate in prescribed processes for facilitating implementation and compliance. Operationally significant commitment is reflected not so much in discrete acts of formal consent as in a continual, if not continuous, process of participation. But continual participation in international efforts of these kinds adds to the burdens of national bureaucracy in general, and of the foreign policy community in particular (Johnston 2003).

The post 1972 era of international environmental agreements has engendered a tendency for big pictures, grand ambitions and grander visions. An inordinate amount of time is spent at large-scale oceans conservation fora developing new, or recognising and reiterating extant global principles, motherhood statements, and lists of generic ‘musts’ and ‘must-nots’ at the expense of devising practical, workable, and most importantly, politically feasible plans for governments to pursue. Hard and soft international environmental instruments and international fora provide fertile ground for development of sound basic principles and ideals, but they often fall short of identifying the necessary and sufficient conditions for putting principles into practice. The 2002 WSSD Johannesburg Plan of Implementation, for example, articulated a number of important macro-goals, however participating governments did not indicate how they would reach such goals and as such, acknowledgement of the Plan was left at the level of “ambiguous, unenforceable promises” (Wapner 2003). The high seas MPA epistemic community may find its vision in similar circumstances in its pursuit of a global, temporally-defined macro-goal to protect deep oceans biodiversity

The high seas epistemic community’s ‘fit’ in the global oceans governance *cas* can be viewed as tenuous at best when it persists in promoting fixed and finite goals in a systemically dynamic, organic and adaptable environment. As this chapter has revealed, when an existing model is predicted to produce outcomes acceptable to proponents of a concept or ideology, there is little incentive to adopt a critical perspective or search for alternative means of understanding a problem. When agents become ideologically immutable, they also become more vulnerable; the challenge lies in the agent maintaining its relevancy and legitimacy (its niche) in a constantly shifting environment where other agents are adapting and changing in order to survive. Survival of the fittest applies to all agents in any type of system, be it animal kingdom or a human social system, therefore in order for an idea or an agent to remain integral to the system itself, it must be open to all types of information, prepared to adopt a critical perspective, and seek alternative means of tackling the problem to adapt to the dynamic environment in which it exists.

One of several perverse outcomes in the approach that the high seas epistemic community has taken thus far is that the primary tag has set the precedent for the development of high seas MPA models through expectations that they be representative, preferably part of an MPA network, and embedded in a global system to be achieved by a specified time. Drilling deeper into the concepts of *representivity* and *networks* as part of the semantic deconstruction of the primary tag, as done earlier in this chapter, revealed numerous contradictions and impracticalities and demonstrated the need for advocacy groups to contemplate and understand what it is they are advocating. Environmental law and policy literature is awash with examples of statements, goals and aspirations that have been massaged or shoehorned to fit eco-ethical ideologies, but which on closer analysis, are utopian, impractical, overly-ambitious and sometimes grossly inaccurate. The influence of such generalised and overtly ambitious eco-ethical ideals is evident, for example, in the EU Presidency Statement to the 2006 ICP meeting regarding the utility of ecosystem based management as a tool for protecting oceans biodiversity when there was no evidence upon which to base the following sweeping and subjective statement:

> Marine protected areas and the fulfilment of the WSSD goal to establish a global representative system of MPAs by 2012 in our view have an important role in an ecosystem based oceans management as they provide a basis to overcome the largely sectoral management and help to address the full scale of threats to marine ecosystems in a holistic manner (EU 2006).

As we have seen, another example is the concept of MPA networks, which represent single species focus by default and ultimately contradict the holistic drivers behind calls for protection of oceans biodiversity persist. The concept of networks seems like a grand aspiration, however, as demonstrated earlier in this chapter, how practical is it in real terms? Where is the science-based evidence that networks and corridors have worked on land, let alone the oceans? This chapter has demonstrated the futility of persisting with the concept of MPA networks and the issues that arise when agents embrace a holistic, fuzzy and 'feel-good' concept without considering and analysing its connections with pragmatism and reality, and with little, if any, tangible evidence.

As we approach 2012, and with a high seas marine protected area yet to be established, the primary tag might be in danger of losing its legitimacy and relevancy, weakened through constant recycling and over- ambition, absent any pragmatic, achievable strategies compounded by lack of political will among the parties who pay lip service to the need to protect oceans biodiversity but fail to put words into action. Compounding this challenge is the absence of any description or definition of what constitutes a *global representative system of MPAs*. Without this level of detail – for instance, defined area of coverage, or specified number of MPAs – how does the international community know when or whether this system has been achieved? What represents success?

The high seas epistemic community continues to view oceans governance as a series of linear, cause-and-effect actions and responses however, as discussed in Chapter Three, linearity is antithetical to the essence of complex adaptive systems. The high seas epistemic community's primary tag is testimony to this linear approach, as is the '*fisheries crisis → failure of existing fisheries management institutions → need for MPAs*' line of logic described earlier in this chapter (Le Quesne 2008). The high seas epistemic community examines and critiques the parts of the global oceans governance *cas* as distinct (although not necessarily mutually exclusive) parts, for example, fisheries management, shipping regulations, or the impacts of marine scientific research. A more prudent approach to the development of environmental instruments and measures is that which can be achieved incrementally through social, 'small scale' change.

In order to encourage some tangible action toward the creation of high seas MPAs, the high seas epistemic community would be better served by becoming more diverse in its membership and opening its feedback loops to flows of information, ideas and opinions that challenge current high seas MPA discourse. Diversity is the upshot of progressive adaptation and integral to the evolutionary process that underpins the survival of agents and the *cas* itself. Diverse information and opinions may compel agents to examine their own convictions, or encourage new approaches to problem solving. Likewise, the 'Level II and III' institutions in the global oceans governance *cas* hierarchy – for example, the IUCN, WWF, the UNGA, and the CBD – might also benefit from revisiting and analysing the ideals that have become orthodoxy in discussions on the protection of high seas biodiversity – the persistent use of the primary tag being a prime example – and open up their information nodes to a freer flow of ideas and challenges.

As we shall see in the next chapter, the long run behaviours of these institutions in relation to high seas MPAs may be shortened if the focus shifts to a more pragmatic and relatively expedient alternative to the high seas epistemic community's preference of embedding MPAs in areas beyond national jurisdiction in *a global representative system of MPAs by 2012*. Chapter Seven explores the creation of a prototype high seas MPA built on informal agreement among a small number of countries that are *directly* involved in the deep ocean activity that is garnering attention. This approach represents the *first real* test of political will and commitment of countries involved in the activity to protect vulnerable geomorphic features in waters beyond national jurisdiction. As we shall see, commencing with a prototype also circumvents the need for significant capital investment, as the estimated cost of between $US5 billion and $US19 billion to administer and manage a global representative system of MPAs would test the intestinal fortitude and commitment of most if not all nation-states in the global oceans governance *cas*. The estimated $US19 billion to create such a system would certainly do little to encourage the process of creating a *global representative system of MPAs by 2012*.

CHAPTER SEVEN

INNOVATION, DIFFUSION AND ADAPTATION: A PROTOTYPE HIGH SEAS MARINE PROTECTED AREA TO TEST THE CONCEPT

Given a desired state of affairs and an existing state of affairs, the task of an adaptive organism is to find the difference between these two states, and then to find the correlating process that will erase the difference.

Herbert Simon (1962, 479).

Introduction

Chapters Four and Five described the emergence of the macro-goal in the international environmental arena, the emergence of the high seas epistemic community, and how this community has influenced high seas marine protected area discourse for over three decades through the repeated use of its primary tag of *a global representative system of MPAs by 2012*. Chapter Six deconstructed and analysed the semantics of this discourse and examined how the operation of environmental institutions influence the growth and dissemination of knowledge. This chapter builds on the high seas community's proposal for pilot high seas MPAs described in Chapter Five, a proposal which the community does not seem to have pursued with any renewed vigour.

I explore the potential for a high seas MPA pilot site through the lens of Lasswell's 'prototyping' (1963) and Rogers' diffusion of innovations (1995) against the backdrop of the *cas* paradigm. To build a case for a more pragmatic and achievable process for creating high seas MPAs, the section on prototyping and diffusion of innovations is prefaced by a discussion of the managerial relevancy and natural appropriateness of small scale agreements against the backdrop of Jacobson and Brown Weiss' strategic design framework for engaging countries in environmental accords (1998), and of course, the *cas* metaphors. I will take my argument for a high seas MPA prototype a step further by suggesting it be realised through an informal accord between a few relevant parties ("mini-lateralism"[84]), rather than a multilateral global treaty, thereby reducing some margins for error because of the 'trialability' of the prototype, and the capacity to demonstrate its relative advantages or disadvantages on a significantly smaller geopolitical scale than that being proposed by the high seas epistemic community. A prototype high seas MPA, if successful, represents the ideal building block on which to base further development of marine protected areas beyond national jurisdiction.

As argued at length in the previous chapter, embedding the argument for high seas marine protected area within the *global representative system of MPAs by 2012* tag is subjecting the creation of high seas MPAs to failure on a number of planes. Compounding the challenge of creating marine protected areas in waters beyond national jurisdiction is the epistemic community's preference that they be legitimised through a legally binding global instrument or implementing agreement to the LOSC. This traditional and stylised view of international law is built on simplistic and linear assumptions that: (i) countries will accept an international accord because they believe that to do so is in their best interest; (ii) as a result of step one, compliance will be *fait accompli*; and (iii) sanctions will be employed to punish non-compliers, thereby encouraging compliance and discouraging non-compliance (Jacobson and Brown Weiss 1998).

The 'macro-approach' to international environmental law – that is, environmental NGOs' predilection for the global application of environmental instruments – makes achievement of the eco-ethical principles underpinning such law much more difficult. There is a disjunct between the idealism of NGOs, their somewhat bipolar view of international environmental law, and the harsh realities that hinder ratification at the nation-state level. The margins for error, realised through states declining to sign; signing but not ratifying; or ratifying but not complying, increase with the number of parties involved in the negotiation process. Evidence demonstrates that implementation of, and compliance with international instruments is not stylised and linear but

[84] The term 'mini-lateralism" was suggested by Matthew Sussex and employed by Kellow (2006, 302).

“haphazard and ragged” (Jacobson and Brown Weiss 1998). These challenges highlight one of several paradoxes in the high seas epistemic community’s approach to high seas MPAs, that of calling for yet another global, legally binding instrument or revision of the LOSC or CBD on the one hand, while frequently criticising the efficacy of those environmental agreements already in place (or awaiting the requisite number of ratifications by parties to enter into force), on the other.

The work of Norton and Ulanowicz is referred to a number of times throughout this thesis in the context of establishing boundaries for systems analysis. They emphasise that selecting scales and determining boundaries in any complex adaptive system “...represents conceptualisations of the system that are *managerially relevant* and *naturally appropriate*” (Norton and Ulanowicz 1992, 247 original emphasis). As Chapter Six emphasised, existing large scale (global) instruments are manifestations of lowest common denominator outcomes achieved through conference diplomacy and consensus – maximum physical involvement for minimal policy outcome (quantity over quality). In many cases, the gaps between signing, ratification and entry into force are considerable. The processes of negotiation and realisation can become so protracted that the socio-political and/or economic environment in which negotiations commenced will have changed significantly by the time the instrument is finally eligible to enter into force (Johnston (1997, 149-50). Global or large-scale regional instruments might be ‘marketed’ by environmental NGOs as the unblemished fruit of internationalism in an ideal world, however, the benefits of time and the luxury of hindsight inevitably raise questions about the managerial relevance and natural appropriateness of the majority of these multilateral constructs.

In contrast, smaller scale agreements show promise because of the prospect of improved ‘achievability’. While Chapter Three pointed out that control is highly dispersed in *cas*, complex adaptive systems do have leverage points whereby small amounts of input have the capacity to produce significant changes. A prototype is an example of a leverage point that can be created with a relatively small amount of input, but with the capacity to produce significant changes in the global oceans governance *cas*.

Simon (1962, (472-73) saw problem solving as a process of natural selection and drew parallels between biological evolution and human problem solving. He noted that trial and error was not random but a highly selective process – agents examine the "new expressions" arising from the transformation of existing ones, and decompose them to see whether they represent progress toward the goal. Signs of success encourage a further search in the same direction. Should progress slow or stop, the direction is abandoned and a new one pursued, indicating that problem solving involves "selective trial and error" (Simon 1962, 472).

A high seas MPA prototype would represent a 'new expression' arising out of the current oceans governance discourse, and if successful, symbolise a small, but not insignificant step toward the larger goal of protecting oceans biodiversity through a process of selective trial and error. As I have already argued in Chapter Six, one of the problems with the primary tag of *a global representative system of MPA networks by 2012* and the fit of the high seas MPA concept within this tag has been that of promoting a temporally fixed macro-goal (a selective error) without focusing more on the acceptability and development of the first 'micro-step' of a selective trial. It is timely that the high seas epistemic community, as an adaptive organism in global oceans governance *cas*, re-frame its high seas MPA discourse, abandon the 2012 temporal goal, and find the correlating process that will erase the difference between action and inertia on a managerially relevant and naturally appropriate scale.

This chapter goes further than the "Steps to Designation" for the creation of pilot high seas MPAs identified by the high seas epistemic community at the 2003 Malaga Workshop because it uses agreements which have been developed since that meeting. Although not yet in force, the *Titanic* Agreement provides a template for developing a prototype high seas MPA and will be examined in some detail together with an overview of the Endeavour hydrothermal vent MPA in Canadian waters (declared in 2003) and the WWF Rainbow hydrothermal vent MPA proforma first submitted to the OSPAR Commission in 2005. The best elements of each will be teased out to inform the development of a prototype high seas hydrothermal vent MPA. This chapter will also examine and explain the rationale for a ‘mini-lateral’ informal agreement, and explain the benefits of such an accord for the potential development of high seas MPAs with a little help from Lipson (1991) and his discussion concerning the costs and benefits of informal international agreements. I commence, however, with Jacobson and Brown Weiss’ organising framework (1998) within which to develop strategies for reaching agreement to, implementation of, and compliance with environmental agreements.

The Managerial Relevance and Natural Appropriateness of Small Scale Environmental Agreements

Jacobson and Brown Weiss’ Implementation and Compliance Model

Jacobson and Brown Weiss have constructed an intuitive and rational model for developing strategies designed to enhance the continued development of international environmental agreements and reinforce implementation and compliance (Hall and Haward 2000, 185). The model, based on extensive research of the efficacy of a handful of existing multilateral environmental instruments, provides a clear view of the way the key factors interact and the relative importance of each. Factors (generalisations) are grouped into four broad and inextricably linked categories (1998, 520):

1. The characteristics of the activity involved;
2. The characteristics of the accord[85];
3. The international environment; and
4. Factors involving the country.

The Characteristics of the Activity Involved

Jacobson and Brown Weiss’ study of several international environmental accords confirmed the conventional wisdom that the smaller the number of actors involved in the activity, the easier and less resource-intensive it is to reach agreement and control the actions of parties to that agreement (Hall and Haward 2000, 185). The effect of economic incentives is also important. The chances of compliance improve when there are complementary or non-competing economic interests among parties, so intuitively,

[85] I use the terms *accord* and *agreement* interchangeably in this chapter to indicate informality. Both terms have the same meaning.

the chances of non-compliance increase when conflicting economic interests are at play (Hall and Haward 2000, 185; Jacobson and Brown Weiss 1998, 521-523).

Another important consideration is that of crafting the accord to ensure the burden of compliance rests with a manageable number of actors and to target those actors directly involved in the activity (Jacobson and Brown Weiss 1998, 523, 552). For instance, if only a small number of countries undertake marine scientific research at a particular hydrothermal vent site, then it is these countries that should be the focus of negotiations to develop and implement an informal agreement for a prototype hydrothermal vent MPA.

Kellow makes the same point about keeping numbers manageable in his analysis of the efficacy of the Kyoto Protocol model, which was created with the intention of reducing greenhouse gas emissions. His view is that the Protocol ultimately "represented a failed approach to the problem of climate change" (2006, 287). He describes the Kyoto model as one striving to build on epistemic consensus, and consensus among the maximum number of parties in a global approach to what was perceived to be a global problem. While the process was driven by the strong normative arguments of international environmental NGOs, negotiations ultimately culminated in a lowest common denominator outcome comprising contradictory standards to excuse and pacify developing countries, "creative ambiguity", and "iterative functionalism" (Kellow 2006, 290, 293; see also Boehmer-Christiansen and Kellow 2002). Kellow argues that in contrast to the over-ambition and under-achievement of the Kyoto Protocol, the 2006 Asia-Pacific Partnership (AP6) represented a far more pragmatic approach to emissions reduction and a more appropriate model for negotiating international/regional environmental agreements. The AP6 involved a partnership between the six parties responsible for half of the world's existing emissions – Australia, India, China, Japan, Korea and the US – thereby enabling opportunities for an achievable policy agreed between those with the capacity to make a difference. The AP6 also has the potential to involve more Asian-Pacific countries should political momentum on emissions reduction gathers pace (Kellow 2006, 287, 290).

The role of multinational corporations in the activity under consideration should also be taken into account when negotiating and implementing a new agreement (Jacobson and Brown Weiss 1998, 523). Again, the example of marine scientific research can be used. Some of the research projects being undertaken at hydrothermal vent, cold seep and pockmark sites around the world are funded by multinational corporations.

Biotechnology companies are interested in endemic chemosynthetic organisms and their potential for use in a pharmaceutical, industrial and cosmetic applications (see Chapter Two and Leary 2004). Deep sea mining companies are also continuing to experiment with methods of extracting polymetallic massive sulphides found at significant depths and assessing the extent of valuable metals and precious stones believed to be at some hydrothermal vent locations.

Characteristics of the Accord

According to Jacobson and Brown Weiss, the characteristics of the accord make a difference – opportunities for implementation and compliance with the accord will be enhanced if parties feel that the obligations are equitable, precise, simple and clear (1998, 524).

Because of the often highly technical nature of environmental accords and the dynamic economic and scientific environment in which they exist, they need to include provisions for gathering and using scientific and technical advice. There also needs to be broad consensus among parties regarding scientific and technical issues (Jacobson and Brown Weiss 1998, 525), and a shared respect for the sources of information that are accessed.

Requiring parties to report regularly on policies and regulated activities adopted at the domestic level represents one of the few opportunities available for evaluating the extent of implementation and compliance (Jacobson and Brown Weiss 1998, 525). As Hall and Haward note, this process also engenders a more disciplined approach among parties (2000, 186). File sharing among parties is critical, enhancing as it does the equitable nature of the accord and improving the intellectual capital that the accord itself may generate.

Multinational corporations (MNCs) and non-government environmental organisations can also play valuable roles by providing information on scientific, technical, and behavioural issues to accord parties and to the broader public (Jacobson and Brown Weiss 1998, 527), and publicising activities that can prompt governments to provide more accurate activity and compliance reports (Hall and Haward 2000, 186).

A competent and effective Secretariat is essential for harnessing information and clarifying procedures for parties, for providing a central point for record filing and storage, providing administrative assistance as required, and ultimately playing a central role in furthering implementation and compliance (Jacobson and Brown Weiss 1998, 526).

Finally, a sensitive mix of incentives and coercive actions can enhance implementation and compliance. Financial and/or administrative assistance can help parties comply with their obligations under the accord. Sanctions (for instance, trade restrictions) may also encourage compliance (Jacobson and Brown Weiss 1998, 527-28).

The International Environment

The international environment is shaped, inter alia, by NGO advocacy, public awareness campaigns, mobilisation of the media, major international conferences, regional concerns, the roles of international financial institutions such as the World Bank, and the number of states expressing interest or concern around a particular issue (Hall and Haward 2000, 187).

The success or otherwise of a proposal for an international environmental instrument hinges on the development of momentum driving the issue and perceptions of legitimacy regarding the proposed solution (an instrument or accord). Much depends on the structural component of the distribution of social and individual control over the activities impacting on ‘the environment’ and how this will, or will not, influence the degree of compliance.

Legitimacy is critical in complex adaptive systems. The challenge lies in the agent maintaining its relevancy and legitimacy in a constantly changing environment so that it can continue to occupy its niche within the *cas*. In international relations theory, legitimacy comprises two parts: (i) the “property of a rule or rule-making institution” should “itself exerts a pull toward compliance on those addressed normatively”; and (ii) the actors addressed by a rule or rule-making institution must perceive “that the rule or institution has come into being and operates in accordance with generally accepted principles of right process” (Frank 1990).

The legitimacy of international regimes (those that exist as well as those being proposed) can be evaluated according to two sets of criteria: (i) the extent to which the rules are applicable (applicability); and (ii) the level of acceptance of these rules by those to whom they apply (acceptability) (Stokke and Vidas1996). There are both internal and external aspects to these sets of criteria. Internal applicability covers the extent to which rules are considered by agents as supporting the solution to the problem; the internal consistency of the rules; and the clarity of the ‘message’, that is, the need for the text of the rule to spell out clearly and succinctly what is required (Frank 1992; Hall and Haward 2000, 188). External applicability refers to the structural and normative components of a regime or instrument and its consistency with significant developments in the international community (Hall and Haward 2000, 188), in other words, its relevancy and legitimacy in a dynamic, adaptive environment.

Internal acceptability encompasses the extent to which the parties to a regime or accord acknowledge, implement and adhere to its provisions and the level of support demonstrated by parties in international fora and in interactions with other parties (Stokke and Vidas (1996; Hall and Haward 2000, 188). External acceptance involves the level of acceptance by third parties and is usually revealed through their attitudes to the regime or accord on a scale ranging from criticism to opposition, indifference, acquiescence, acknowledgement and/or accession (Stokke and Vidas 1996).

An accord with high levels of internal and external applicability and internal and external acceptability has a correspondingly high level of legitimacy, which in turn motivates compliance with the rules of the accord. This underlines the import of building legitimacy in order to strengthen compliance, however, at the heart of this discussion on the factors important to the success or otherwise of the accord the features of the countries involved.

Factors involving the country

A country's history, culture, physical characteristics, political institutions, and economic conditions influence, (directly and indirectly), its implementation of, and compliance with, an international environmental regime or accord. Another important dynamic is the country's behavioural history and attitudes during negotiations for previous environmental agreements, and perhaps its participation in discourses regarding the issue being addressed at the international level.

While these factors are important, Jacobson and Brown Weiss identify four key proximate factors that impact on the performance of a country in the international environmental arena: (i) administrative capacity; (ii) leadership; (iii) NGOs; and (iv) knowledge and information (1998, 530-35). Obviously, countries with strong administrative capacity do better than those that do not. Access to knowledge and information, educated and trained personnel, and financial support; an appropriate legal mandate that affords the country authority; and the administrative capacity to meet the demands placed upon it, are crucial elements underpinning a country's ability to meet the obligations imposed by its agreement to a party to an international instrument or accord (Jacobson and Brown Weiss 1998, 530-31).

The role of NGOs in international regime formation, implementation and compliance has been discussed and analysed at length in the previous chapters addressing international oceans biodiversity forums and high seas MPA discourse. Their role in the international environmental arena can be a bittersweet one. On the one hand, they mobilise public opinion through concerted media campaigns, bring pressure on governments to respond to NGO's environmental concerns and influence political issue agenda settings (Jacobson and Brown Weiss 1998, 533). They provide public access to a wealth of information on environmental issues, and many have become highly adept at lobbying governments and existing multilateral convention administrations to take up their concerns at regional or global levels, thereby influencing the direction and tenor of the negotiating process.

On the other hand, some international NGOs can be quite selective with the knowledge and information they access and share with the wider community. As discussed in Chapter Six, they can, as international environmentally ideological regimes in their own right, "affect the growth of knowledge by guiding its application to public issues, and as a consequence, enhance the credibility of favoured streams of research" (Young 2004, 222). They also have a propensity for reinforcing their messages in strong morally suasive terms. For instance, Greenpeace claims that "high seas oceans management is fundamentally flawed", thereby "creating the biggest unseen and potentially irreversible environmental disaster of our time" (2005, 1). In a similar vein, WWF asserts that:

> Seventy-six per cent of world's fish stocks are now fully exploited, overfished or recovering from collapse. Important habitats are being lost and degraded worldwide. Marine biodiversity is threatened. And the traditional basis of life for millions of people, and even entire countries, is being eroded – leading to increased poverty by depriving communities of their livelihoods and reducing food security (2005, 1).

At issue is not the information itself; rather it is the use of dramatic language from the outset of a campaign, a strategy which leaves little scope for further embellishments. There is also the potential for creating 'environmental fatigue', where information depicted repeatedly in strong terms may cause the audience to 'switch off'. Many countries involved in multilateral negotiations are also highly selective with the knowledge and information they share with NGOs, providing only that which may paint the incumbent government in a desirable domestic and international political light. There are also issues of diplomacy and commercial confidentiality which countries must take into account during the negotiation, agreement, implementation and compliance phases of the accord. This constitutes knowledge and information which cannot or should not be shared with non-government organisations.

Leadership is the final proximate factor involving a country's implementation of, and compliance with, an international environmental accord. Hall and Haward (2000, 185), drawing on the work of Young (1989, 1994), define the term *leadership* in reference to the actions of agents (individuals, countries, NGOs, and international governmental organisations) attempting to find solutions to collective action problems in the international governance arena.

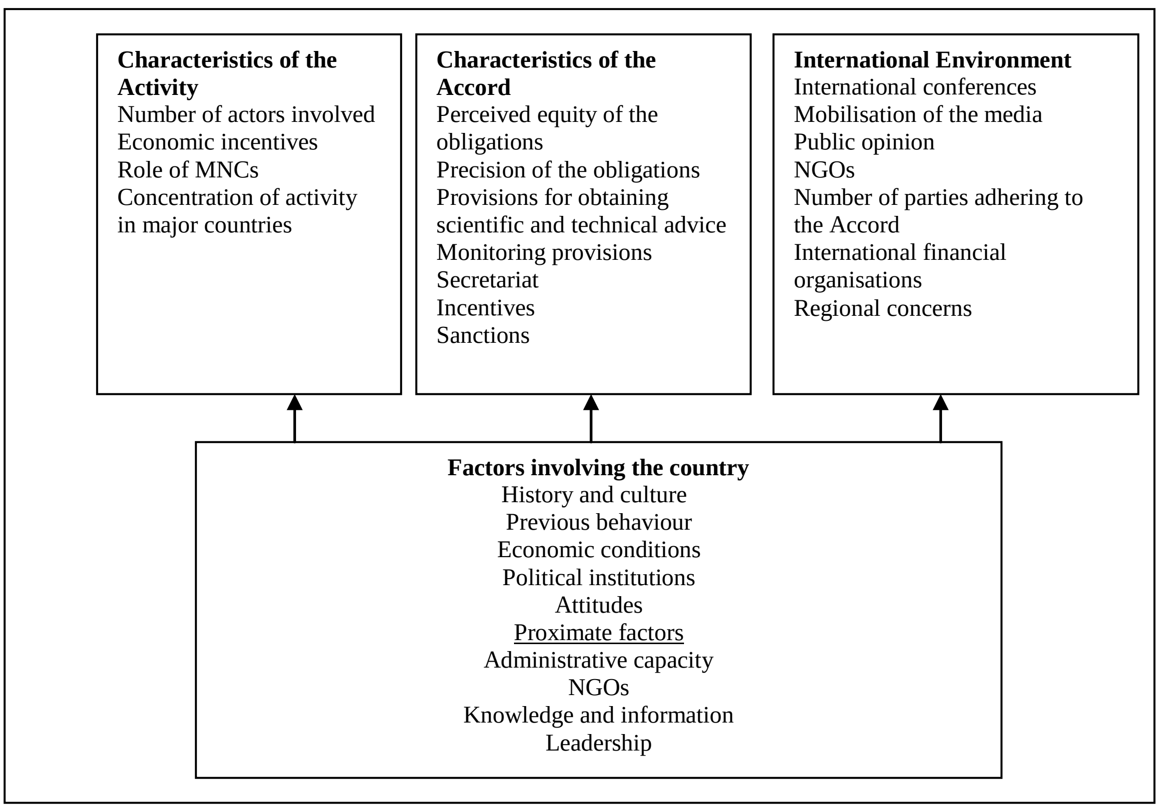
According to Jacobson and Brown Weiss (1998, 534), individuals do "make a crucial difference", whether it be motivating action or encouraging implementation of, and compliance with, an accord. One need only recall Dr Arvid Pardo's stirring oration to the UN General Assembly in 1967 regarding the potential mineral wealth that lay on the seafloor and how it ultimately led to the inclusion of the concept of "the common heritage of mankind" in the Law of the Sea Convention. As a leading advocate for environmental causes in his home country, Brazilian President Fernando Collor was the key influence in Rio de Janeiro being selected as the host city for the 1992 Earth Summit (Jacobson and Brown Weiss 1998, 534). The American deep ocean explorer, Robert Ballard, one of the joint leaders of the expedition that discovered the wreck of the *Titanic* in 1985, was instrumental in the US' involvement to protect the fated ocean vessel in its high seas grave, and its culmination in an international accord to preserve *in situ* what remained of the vessel and its artefacts (Dromgoole 2006, 3).

Summary of the Implementation and Compliance Model

Figure 1 represents a summary of the four broad groups of factors that influence the degree of subscription to, implementation of, and compliance with a multilateral environmental accord. Jacobson and Brown Weiss (1998, 520) grouped factors (generalisations) into four inextricably linked categories to form the basis of a rational model for developing strategies designed to achieve implementation of, and compliance with an accord.

The key point in the first category – *the characteristics of the activity involved* – is that the smaller the number of actors involved in the activity, the easier and less resource-intensive it is to agree to an accord and control the actions of those who choose to be parties to it (Olson 1968; Hall and Haward 2000, 185).

Figure 6: Four broad groups of factors that influence implementation and compliance (adapted from Hall and Haward (2000, 186) and Jacobson and Brown Weiss (1998, 536).



The second category addresses the *characteristics of the accord* itself. An effective accord needs to be built on equity, simplicity, clarity and precision. It should comprise a competent secretariat, regular reporting mechanisms and a regular reporting schedule, and implement a file sharing process to enhance knowledge and information pertaining to the accord (Jacobson and Brown Weiss 1998; Hall and Haward 2000).

The third category, the *international environment*, concerns issue momentum in the multinational arena, both publicly and diplomatically. A significant point in this category is the legitimacy of the issue *and* the proposed solutions. Within the international relations complex adaptive system, legitimacy relates to the properties of the rule or the rule making institution; and the perceptions of those who are the targets of the rule (Frank 1990). Internal and external applicability and acceptability of the solution, the rules imposed to reach the solution, and the normative and structural components of the regime or accord are also crucial factors in shaping the relevancy and legitimacy of the proposed solution in a dynamic, adaptive international environment (Frank 1992; Stokke and Vidas 1996; Hall and Haward 2000).

The fourth and perhaps most critical category is *factors involving the country.* In summary, the country's culture, international and domestic behavioural history and patterns, its administrative culture and capacity, the influence of NGOs on its policy agenda settings, the strength of leadership, and the level of knowledge and information about the issue under negotiation determine its involvement (or non-involvement) in relation to the accord or regime being proposed (Jacobson and Brown Weiss 1998, 530-33).

A Pragmatic Approach to the Development of High Seas Marine Protected Areas – the Prototype

Prelude: Macro-Goals or Micro-Actions?

The primary tag of a *global representative system of MPAs by 2012*, its mismatch of scale, and the 'unfitness' of its characteristics of immutability and linearity in a system where non-linearity is a basic feature, (the global oceans governance *cas*), is problematic on a number of counts. To restate a couple of key points made in Chapter 5, while the primary tag appears to be stating a clear goal, this goal becomes increasingly opaque when scrutinised. Chapter Six teased out the paradoxes that were revealed through deconstructing the primary tag of a *global representative system of MPAs by 2012* and raised questions about the characteristics and definitions of a global representatives system. Again, it must be asked: Is it a particular number of MPAs within and beyond national jurisdiction, or a specified percentage of area of seabed and/or water column afforded protection through spatial demarcation? How 'representative' can this system be when we know so little about the biodiversity and geomorphology of the deep ocean? Is the main aim of the high seas epistemic community to ensure protection for representative areas, or features that are unique or rare, or a mix of both?

With the high level of biotic endemism found at each of the hydrothermal vent fields, seamounts, cold seeps, trenches, sponge fields and canyons that have been scientifically investigated, (and noting that little more than 0.0001 per cent of deep oceans environs have been scientifically investigated (Baker et al 2001, 5)), how 'representative' can this global representative system be? What are the advantages of a defined and relatively short time target? What benefits can be derived from embedding high seas MPAs in a global treaty or implementing agreement to the LOSC? Chapter Six unpacked, analysed and critiqued the discourse of the high seas epistemic community around high seas MPAs detailed in Chapters Four and Five and found little substance with which to answer these key questions.

Chapter Six also queried the *raison d'être* behind advocacy for the establishment of high seas MPAs. The argument of proponents is that they be created in areas that lack them rather than any bona fide attempt to contribute to empirical MPA science, and further, that they are an essential component of a global representative system of MPAs. Willis et al (2003) reminded us that MPA literature is replete with modelling and speculative work that supports the creation of MPAs *in theory*, however, empirical field data proving their value remains thin on the ground. As such, model assumptions have evolved into conventional paradigms, with MPA advocates of the view that if everybody (primarily scientists and MPA proponents) says it then it must be true (Willis et al 2003, 98 emphasis added).

As discussed in Chapter Six, the 20 per cent no-take MPA figure has been elevated to that of dogma in decisions concerning the minimum proportion of ecosystems that must be demarcated to be effective (Agardy et al 2003, 361). The authors were motivated to explore the evolution of this dogma because of:

> ... the fervour to proclaim sometimes untenable policy prescriptions, the tendency to decree as many MPAs as possible, an eagerness to do so without a clear understanding of many of the complexities or balanced framework required, and a zealous ‘one size fits all’ approach [that] may inadvertently impede success. A policy backlash against the...use of marine protection tools may loom at the time when MPAs are needed most (Agardy et al 2003, 354).

These concerns are echoed when one analyses critically the high seas epistemic community’s approach to the creation of high seas MPAs, and its preference for embedding them within a *global representative system ... by 2012*. Kellow’s conclusion regarding the Kyoto model of reducing the impacts of climate change, as outlined earlier in this chapter, was that it was striving to build a case on: (i) epistemic consensus; and (ii) consensus among the maximum number of parties in a global approach to what was perceived to be a global problem (referred to as the macro-approach in this thesis). A similar conclusion can be reached about the high seas epistemic community’s preferred approach to high seas MPAs. Like the Kyoto model, high seas MPA discourse is driven by the strong normative arguments of international environmental NGOs, a case built on epistemic knowledge and shared eco-ethics, and a mission for achieving broad scale consensus on a global representative system of MPAs among the maximum number of states. As argued in Chapter Six, however, the preoccupation with global solutions for marine protected areas will, in all likelihood (and perhaps inevitably), result in lowest common denominator outcomes comprising a mix of contradictory standards to excuse and pacify developing countries, blended with “creative ambiguity” and “iterative functionalism”, as occurred during and after the development of the Kyoto model (Kellow 2006, 290; see also Boehmer-Christiansen and Kellow 2002).

What alternatives to the macro approach to high seas MPAs might prove potentially more successful? As discussed in Chapter Five, pilot high seas MPAs were identified as an important component of the global representative system of MPAs at the 2003 Cairns and Malaga Workshops, the 2005 IUCN 5th WPC, in the WCPA – Marine Ten Year Strategy, the AHTEG, and the Un Ad Hoc Open-ended Informal Working Group on Oceans and Law of the Sea. There is, however, little evidence that the concept of pilot sites has been pursued with any vigour or commitment. Instead it appears that the goal of *a global representative system of MPAs by 2012* and the high seas epistemic community's propensity toward embedding this goal in a legally binding global instrument has subsumed the more pragmatic and achievable alternative of a high seas MPA 'pilot' or prototype.

In the *cas* paradigm, the effectiveness of the agent's internal models rests on the agent finding an appropriate way of connecting future credit to current actions – evolution will favour effective internal models and eliminate those that are ineffective. The high seas epistemic community's primary tag has emerged from the eco-ethical internal model of its members, however, if this global representative system of MPAs is not achieved by 2012 (which, not withstanding the absence of any detail on what constitutes such a system, seems the most likely outcome), then the internal model's effectiveness will be challenged in the context of high seas MPAs and the linear primary tag considered null and void. If the global system of MPAs, including some located within the high seas, does not eventuate by 2012, there will be no 'current action' to link to future credit.

A fundamental building block for the application of prototypes is that the concept should appeal more effectively to others on their own terms. In contrast, the tags, building blocks, and internal models of the high seas epistemic community appeal to those already committed to the cause of conserving or preserving 'nature'. The primary tag of *a global representative system of MPAs by 2012* also appeals to those who see achievement of the ultimate goal as remote and convenient – states so inclined can express concern and yet be required to do little beyond attend forums and agree to motherhood statements and principles of oceans governance because the goal is so vast. To plant the seeds for high seas marine protected areas, the concept needs to attract the 'others' - the uncommitted, the unengaged, the unconvinced and the 'fence sitters'. The key driver here is that the 'others' should be the relevant 'others' – countries whose citizens are undertaking activities in waters beyond national jurisdiction which do, or have the potential to, impact on a section of deep ocean habitat, geomorphology or ecology.

Bearing in mind these considerations, the following section proposes an alternative approach to the creation of high seas MPA, one where a current action has the potential to be linked to future credit. It is the concept of *prototyping,* developed by Lasswell (1963) and expanded by Brunner and Clark (1997) in their work on practical approaches to ecosystem-based management.

The Art and Theory of Prototyping

Recognised as a practice-based approach, a prototype is "an innovation, typically small scale, made in political practice primarily for scientific purposes" (Lasswell 1963, 98). It represents a strategy of inquiry located halfway between a controlled experiment and a full scale intervention. Unlike a controlled experiment, a prototype commences with a guiding goal. In anticipation of unexpected problems or opportunities, however, a generous degree of flexibility is built into the programmatic details designed to achieve that goal (Lasswell 1963, 98-99).

One of the key aims of a prototype is to improve the program through learning by experience. Unlike a full scale intervention, the small scale of a prototype enables it to fly under the political radar in an environment of low visibility and low vulnerability until the results have been evaluated. Should the prototype prove unsuccessful it can be more easily terminated than a full scale intervention because it is less likely to have acquired a critical mass ready and willing to defend it. If successful, it can be diffused laterally and adapted to solve similar problems or challenges elsewhere (Brunner and Clark 1997, 54).

The impact of the prototype proposal is reflected in a mix of short-run and long run behavioural patterns that become evident during the pre- and post introductory phases. The first challenge in the process is identifying when the prototype has been 'introduced', that is, recognising the patterns of behaviour that indicate a degree of acceptance has occurred. According to Lasswell, a prototype is introduced "when an effective *majority* of the leadership is committed to try[ing] out the innovation and agrees that important results may reasonably be expected to flow from it" (1963, 101, emphasis added). Rather than relying on consensus and the inevitable compromises that have to be made to achieve large scale environmental agreements, a prototype needs the support of the majority to enable it to progress, and because it is a micro- rather than macro-action, there is less reliance on compromise to progress beyond the first hurdle of agreement.

One of the many merits of prototyping is that the objectives become clearer through experience. Experience nourishes and expands the suite of considerations that can be taken into account when redesigning the fundamental proposal for future testing, or to facilitate official intervention if required. A principle of prototyping is to encourage the clarification of goals even after support has been achieved; new or reframed objectives continue to emerge and the programmatic details can be adapted according to the benefits of practice and reflection. Even beyond the degree of support that indicates that the prototype has been introduced, important differences will continue to emerge within the framework of consent (Lasswell 1963, 103-104). Because a prototype is not a fixed, immutable one-size-fits-all approach, it can be modelled and remodelled according to experience.

Another point about prototyping that makes it so appealing is that it requires a degree of precision about the specific practice to be initiated and investigated (Lasswell 1963, 105). Brunner and Clark (1997, 51) note in their discussion on practice-based ecosystem management that while moral principles and general goals can be refined and improved through retrospective analysis across a broad range of experiences, specific goals that are appropriate in one decision-making context may not prove appropriate in another. It is not enough to endorse a general value goal (Lasswell 1963, 105) or general law (Simon 1985, 301) – a degree of precision relating to the specific practice under examination is also required (Lasswell 1963, 105). How does one commence a strategy with a suite of tools comprising general goals, maxims or scientifically-premised relationships that are presumed to be universally relevant as is the case with the high seas epistemic community’s primary tag? Context-specific precision is integral to the development of higher standards and better models which in turn motivate agents to take action or, alternatively, explain why they will not (Brunner and Clark 1997, 55).

Simon observed that even physicists "get only a little mileage out of their general laws", and that those "laws have to be fleshed out by a myriad of facts, all of which must be harvested by laborious empirical research" (1985, 301). The observations of pragmatists such as Lasswell and Simon encourage one to question the perspicacity of advocating a macro-approach to the creation of high seas MPAs based on general eco-ethical 'laws'(for instance, the precautionary principle that drives calls for marine protected areas to be created in places where there are none) and general goals (for example, a global representative network of high seas MPAs) absent any "laborious empirical research" (Simon 1985, 301) about the need for their creation when the reasons for, and contexts of, conserving specific marine geomorphologies or areas of ocean space vary so widely. The key point here is that each proposed site should be considered on its merits, that is, on a case by case basis, rather than striving to create and connect nodes of protection across all geopolitical regions merely because they currently lack them.

Lasswell believes that the strategy of prototyping is a means of discovering and developing "newly emerging patterns of institutional life", and that as such "it is "appropriate to speak of 'organic' or 'structural' changes in the social process and to emphasise the opportunity that political scientists enjoy when they are sufficiently in step with change to use the technique of prototyping to expedite potential evolution" (1963, 105-106). To expedite the potential evolutionary process instigated by a prototype, the prototyping strategy must decompose a large scale problem into more tractable parts. It relies on agents within a network of communication and shared experiences to make decisions about a common problem according to their particular set of circumstances and contexts. The communication network provides these agents the opportunity to engage in the processes of innovation, diffusion, and adaptation (Brunner and Clark 1997, 54-55). It is well worth exploring how sound ideas can be generated through *innovation*, *diffusion* and *adaptation* in order to understand the merits of proceeding cautiously and incrementally with the development of high seas MPAs, that is, by embracing the 'art' of prototyping, rather than aiming for the achievement of a macro-goal.

Innovation

An innovation is "an idea, practice or object that is *perceived* as new by the agent of adoption" (Rogers 1995, 11, emphasis added). *Perception* is the key to Roger's definition. In the context of human behaviour, the agent's reaction to an innovation is determined by perception of the 'newness' of the idea, the acquisition of 'new knowledge'. This does not necessarily mean the knowledge itself is new but that the agent has recently 'discovered' it. The 'newness' of an innovation can be expressed in terms of knowledge, persuasion, and/or the decision to adopt. If the idea *seems* new, then it is an innovation (Rogers 1995, 11, emphasis added). Brunner and Clark describe the motivation for innovation arising out of agents abandoning conventional practices in favour of innovations that are crafted to improve or resolve a common problem once it becomes too pressing to ignore (1997, 55). This implies that while the innovation may not necessarily be perceived as 'new', it is perceived as an improvement on previous practices.

Rogers describes innovation as an entity comprising two technological[86] components: (i) technological 'hardware' (for instance machinery or equipment); and (ii) technological 'software' (such as political philosophies, religious ideas, media events, rumours) (1995, 12-13). Some innovations comprise only a software component, so structurally they are far less tangible, are diffused and adopted at a much slower rate and as such, not easily observable. Because of these characteristics, they have not been widely studied in the context of innovation (1995, 13). A high seas MPA prototype would be considered a mix of the two technological components: the hardware component would include the physical boundaries and accord framework; while the software would be the incremental philosophical shift in oceans governance from a macro-goal approach for deep ocean biodiversity protection to a more careful, incremental and practical methodology.

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[86] Rogers describes a *technology* as "a design for instrumental action that reduces the uncertainty in the relationships involved in achieving a desired outcome" (1995, 12).

Technological innovation can increase uncertainty about its consequences on the one hand, while presenting opportunities for reducing uncertainty on the other because potential adopters seek and share information about the innovation, thereby expanding the technology's information base. The innovation decision-making process is essentially an activity comprising information seeking and processing to reduce uncertainties about the advantages and disadvantages of the innovation itself (Rogers 1995, 13-14). This brings us to five critical attributes of innovations that inform the decision making process of the potential adopter and explain differing rates of adoption (Rogers 1995, 15-16). They are:

1. Relative advantage: The degree to which an innovation is perceived to be an improvement on the idea it supersedes. While usually measured in economic terms, it can also involve degrees of social prestige, satisfaction and convenience. The greater the perception of relative advantage, the faster the rate of adoption of the innovation.

2. Compatibility: The degree to which an innovation is perceived as being in harmony with existing values, norms, needs and past experiences of potential adopters – the more compatible the innovation, the more rapid the rate of adoption.

3. Complexity: The degree to which an innovation is perceived as being complicated and difficult to use. The more complex the innovation, the slower the rate of adoption.

4. Trialability: The degree to which an innovation can be experimented with on a restricted basis.

5. Observability: The degree to which the outcomes of an innovation can be seen by others.

These five attributes can lead to a considerable degree of re-invention or modification for many innovations, especially when an agent's use or application of an innovation departs from the initial version of the 'new' idea promoted by the change agency (Rogers 1995, 17). Once these attributes have been satisfied, the innovation can be diffused through the system network.

Diffusion

The diffusion of an innovation refers to the flow of information through the conduits of the information network and the degree to which the innovation is perceived as being of benefit to those facing similar problems. Information flows concerning innovations must be frequent, clear and precise so as to inform de facto (if not de jure) standards of sound practice and "provide field-tested models for meeting those standards" (Brunner and Clark 1997, 55).

The transfer of ideas occurs most often between two or more individuals who are homophilous (the same). In innovation theory, homophily occurs because agents belong to the same organisations or groups, live or work together, or share similar social interests. The high seas epistemic community appears to represent a homophilous group of agents united by a common interest and a shared eco-ethical philosophy regarding the best approaches for protecting the biodiversity of the deep ocean. Homophily generally acts as a barrier to the diffusion of an innovation because when two or more agents grasp the technology of an innovation (for example, the primary tag of *a global representative system of MPAs by 2012*) in an identical way, no diffusion can occur because there is no new information to exchange (Rogers 1995, 19, 288). A high degree of homophily can give rise to diffusion patterns that are horizontal rather than vertical and that have recycled rather than multiplier flows, the net effect being to slow down the rate of diffusion of the innovation across the entire complex adaptive system. As discussed in Chapters Four and Five, the primary tag of the high seas epistemic community has diffused both horizontally and vertically. The problem is that the tag has subsumed other, more pragmatic approaches for the creation of high seas MPAs and flows of information are recycled because there is little if any new information to exchange.

Intuitively then, the nature of diffusion demands that there be at least some degree of difference or heterophily[87] between agents for multiplier flows of information regarding the innovation This brings us back to value inherent in the five key attributes of the

[87]The opposite of homophily, *heterophily* is defined as "the degree to which two or more individuals who interact are different in certain attributes (Rogers 1995, 18).

innovation, that is, the change agent being able to ‘market’ the benefits of the innovation by demonstrating its (i) relative advantage; (ii) compatibility; (iii) simplicity; (iv) trialability; and (v) observability within appropriate ‘economies of scale’. Rogers is of the view that heterophilous communication has “a special informational potential, even though it works only rarely” (1995, 287). Heterophilous network conduits often link two or more distinct agents, thereby spanning two or more sets of socially disparate agents in a system. These heterophilous interpersonal links are especially important in carrying information about innovations across socio-political divides (the multiplier effect of flows of information in *cas*), for instance between Levels I, II and III in the hierarchical organisation of a complex adaptive system. While homophilous communication is recurrent and undemanding (lateral short run behaviours), it is not as crucial as the less frequent heterophilous communication (vertical longer run behaviours) in the diffusion of innovations (Rogers 1995, 287-88). The key remains to communicate the flows of information in a precise, context-specific, and strategically scalar manner.

Adaptation

As emphasised in Chapter Three, *adaptation* is one of the four cornerstones of the complex adaptive systems paradigm, indeed it is “the sine qua non of *cas*” because these systems have the capacity to learn and therefore adapt (Holland 1995, 8-9). Adaptive capacity is what keeps the system ‘alive’. Adaptation is experiential, in other words, experience influences changes in an agent’s structure so that over time it improves the utility of its environment for its own ends – the agent improves its *fitness*. Because the system’s agents are constantly adapting, the system itself is constantly adapting, albeit at a much slower pace because the rate of adaptation is relative to the scale of hierarchical organisation and the patterns of long run behaviours described in Chapter Three. Adaptation and associated adaptive behaviours are “a major source of the complex temporal patterns that *cas* generate” (Holland 1995, 10). By exploring and understanding these ever-changing patterns, we improve our understanding of the particular *cas* we are exploring. As agents in social *cas*, we also learn to adapt our strategies to maintain or improve our fitness in the system. Failure to adapt means failure to survive. Many of the elements of prototyping fit comfortably with the elements of adaptation and *fitness* in a *cas*.

One of the requisites of the ‘art’ of prototyping is the exercise of pressure by leaders (opinion leaders or change agents) on non-leaders to meet the de facto standards of sound practice. This pressure encourages other groups (the ‘relevant others’ referred to earlier in this chapter) to select from the more successful innovation models and adapt some elements of these models according to their own set of circumstances (Brunner and Clark 1997, 55). Rogers emphasises the value of change agents and opinion leaders in diffusing innovations (1995, 26-28, 335-369).

Some agents within complex adaptive systems function as opinion leaders without necessarily being political leaders, although of course, they can be both. Chapters Four and Five of this thesis provide numerous examples of opinion leaders, change agents and change agencies in the global oceans governance *cas*, many of whom are also participants in the high seas epistemic community, including WWF, the DSCC, Greenpeace and IUCN. Examples of opinion leaders are also provided in the overview of Jacobson and Brown-Weiss’ ‘factors affecting the country’ section of this chapter – as described earlier, Dr Arvid Pardo, Robert Ballard, and Brazilian President Fernando Collor are recognised as opinion leaders whom have influenced the adoption of innovative approaches in the international policy arena.

Opinion leadership is the degree to which an agent is able to influence other agents’ attitudes or behaviours, usually in an informal manner and with relative frequency. This quality is not necessarily a function of the agent’s official position or status within the system, but rather, is earned and sustained by the agent’s technical competence, conformity to the system’s norms and level of social accessibility (Rogers 1995, 27). When the system is ready for change, opinion leaders are innovators, and when the system resists change, the behaviours of the opinion leaders reflect this period of stagnation. By conforming closely to the system’s norms, opinion leaders serve as appropriate models and mirrors for the innovation-related behaviours of their followers because they reflect the very structure of the system itself (Rogers 1995, 27).

A complex adaptive system is inevitably a mix of opinion leaders circulating amongst a mix of supporters, agents resisting change, followers of varying schools of thought (depending on the situation), and ‘fence sitters’. When compared with their followers, opinion leaders are more exposed to all forms of external communication, (indeed, they are usually at the centre of interpersonal communication networks), are generally more cosmopolitan, have a relatively higher social status, and embrace innovation, although their degree of innovativeness is contingent on their particular system’s set of norms. Opinion leaders’ position and status can also be tenuous; they can lose the respect of followers should they deviate too far from the system’s norms, or be challenged if they are ‘captured’ by professional change agents because they are seen to be losing their objectivity and credibility (Rogers 1995, 27).

Rogers distinguishes between *opinion leaders* and *change agents* (1995, 27-28), the latter being those whom exert influence in the social and/or political system in a professional capacity, usually have academic qualifications and training in a technical field, and who enjoy the acclaim and social status that usually goes with high level ‘expertise’. Change agents represent change agencies external to the system that is exploring the innovation in a particular context. The change agent steers clients’ innovation decisions in a direction identified as desirable by the change agency. This does not necessarily mean seeking to influence the adoption of new ideas; it may also involve slowing down or stopping the adoption of innovations deemed undesirable by the change agency. Change agents may also “use opinion leaders in a social system as their lieutenants in diffusion campaigns” (Rogers 1995, 27-28).

The experience of building prototypes usually involves partial failures or possibly malfunctions, neither of which necessarily impact negatively on the process. Partial failures draw attention to better strategic options. As Lasswell describes, “one justification for a prototype is that it stimulates the discovery of an improved programme and lays the foundation for orderly replication of the revised prototype model" (1963, 112). The feedback relationship between prototyping and experimentation is emphasised – as the prototype is constructed, the flows of information multiply, thereby facilitating the transition from prototype to experiment through modification of the various features of each prototypical situation in a systematic way. The multiplier effect also means that ideas generated in one context can be used meaningfully in experiments that have little connection to the prototype itself (Lasswell 1963, 112).

Malfunctions occur, for example, when claims of success are exaggerated or unfounded; the diffusion of higher standards and improved models is restricted or unorganised; or the resources for adaptation, such as time, money and leadership are unavailable. Positive lessons can be drawn from the experience of malfunctioning – for instance, improvements to future programs or processes, better organisation, more open channels of communication, commitments to resources through improved planning and management, and agreement on what constitutes success before the prototyping program commences (Brunner and Clark 1997, 55).

Complex Adaptive Systems, the Prototype, and the Political Dynamic

Cas and Prototyping

Lasswell's *prototyping* 'fits' comfortably with the elements of the *cas* paradigm and vice versa. As explained thus far, the prototype, if successful, is emergent; adaptive; facilitates context-specific behavioural patterns; is contingent on multiplier flows of information within the network to create a niche for the prototype within the system; and constitutes a building block for future decisions concerning similar problems or challenges which may or may not evolve into an internal model. Prototypical units can be developed laterally and/or vertically and in any direction in every existing hierarchical structure. Essentially, a prototype represents a small step toward solving a larger problem without the constraints of a full blown experiment or grandiose plan.

Prototyping and high seas MPAs

The environment in any given point of time and place within the global oceans governance *cas* is a key determinant of an agent's behaviour within that system. As described by Holland in his work on complex adaptive systems:

> ...if the resulting actions anticipate useful future consequences, the agent has an effective internal model; otherwise it has an ineffective one. With an appropriate way of connecting future credit to current actions, evolution can favour effective internal models and eliminate ineffective ones (1995, 33-34).

Prototyping provides a means of revealing the predispositions of the political process at any particular time and place, and how future credits can be connected to current actions. The Chapter Four and Five fora reviews identified patterns of behaviour in discourses addressing high seas MPAs that spanned several decades and occurred in numerous institutional settings and geographic locations, however, despite the emergence and persistence of the high seas epistemic community's primary tag, there has been little progress with any of the building blocks designed for their creation. Recurrent commitments for resources to address the protection of deep oceans biodiversity have been countered by the blocking of firm action at the global level, as is evident in sections of Chapter Five where the views of Parties to the UN and CBD are expressed in regards to high seas governance issues. As such, there has been little progress beyond motherhood statements and reiterations of conservation principles despite decades of discourse promoting the protection of deep oceans biodiversity. The high seas epistemic community has become increasingly frustrated at the lack of progress toward a *global representative system of MPAs by 2012* while at the same time calling for a legally binding instrument or implementing agreement that will ensure the glacial pace of negotiations is maintained and that the achievement of its ultimate goal (the primary tag) remains complicated. There appears to be little in the high seas epistemic community's current action account (apart from the proposal to develop high seas MPA pilot sites) to draw on for future credits.

The task, according to Brunner and Clark, is to design an innovative strategy capable of transforming "the power-balancing process into one that helps participants clarify and secure their common interests" (1997, 56). Further, should this innovative approach fail to transform the power-balancing process, there would at least be clarification on what to do differently, and hopefully better, in the future (Brunner and Clark 1997, 56). Although control is highly dispersed in complex adaptive systems, they have leverage points whereby small amounts of input have the capacity to produce significant changes (Holland 1995, 39; Bar-Yam 1997, 10), including the power-balancing process within that *cas*. Prototypes successfully field tested in one context tend to moderate political opposition to action in others. Tangible results are a critical factor in changing opinion – propaganda alone tends to reinforce existing predispositions or have no effect at all (Lasswell and Kaplan 1950, 113).

The Political Dynamic

An informal small scale agreement that establishes a high seas MPA prototype has numerous advantages in contrast to the high seas epistemic community's preference for a global, legally binding instrument that includes the creation of high seas MPAs in its mandate. Lipson is of the view that informality is "best understood as a device for minimizing the impediments to cooperation, at both the domestic and international levels" (1991, 500). Informal agreements are far more flexible than treaties, in that they can be adapted under certain conditions, and in response to unintended consequences. The process of negotiating informal agreements is far less cumbersome, resource intensive and protracted than that of formal agreements because the former do not require elaborate ratification, and as such can be finalised and implemented quickly if so required. Speed is particularly advantageous in complex, rapidly changing environments (Lipson1991, 500). Lipson also notes that:

> ...informal agreements are generally less public and prominent, even when they are not secret. This lower profile has important consequences for democratic oversight, bureaucratic control, and diplomatic precedent. Informal agreements can escape the public controversies of a ratification debate. They can avoid the disclosures, unilateral 'understandings' and amendments that sometimes arise in the open process. Because of their lower profile, they are also more tightly controlled by the government bureaucracies that negotiate and implement the agreements and less exposed to intrusion by other agencies. Agencies dealing with particular issues such as environmental pollution or foreign intelligence can use informal agreements to seal quiet bargains with their foreign counterparts, avoiding close scrutiny and active involvement by other government agencies with different agendas (Lipson 1991, 500-501).

These benefits are not without cost. The flexibility of informal agreements also renders them more easily abandoned, circumventing public debate avoids gauging the depth of domestic support, and the process of ratification required for formal agreements can mobilise and integrate the many constituencies interested in the subject of agreement (Lipson 1991, 501). Nevertheless, as an exercise in political will and diplomatic innovation, an informal agreement to create and implement a hydrothermal vent MPA prototype in waters beyond national jurisdiction would seem an ideal first step in promoting the concept of high seas MPAs.

Managerially Relevant and Naturally Appropriate Models for Informing the Development of a High Sea Hydrothermal Vent Marine Protected Area

Overview

This section explores three models for informing the development of a hydrothermal vent marine protected area prototype beyond areas of national jurisdiction. These models are:

1. The Agreement Concerning the Shipwrecked Vessel RMS Titanic, which informs the political and rules-based component;
2. The Endeavour Hydrothermal Vents Marine Protected Area which informs the managerial/regulatory component; and
3. The WWF Proforma for compiling the characteristics of a potential MPA (for the Rainbow hydrothermal vent field), parts of which provide a biophysical framework and selection criteria. There are, however, some potential ‘partial failures’ in the proforma which can provide insight into how to improve the model for the high seas hydrothermal vent MPA prototype proposed in this chapter.

The Agreement Concerning the Shipwrecked Vessel RMS Titanic

Background

The Agreement Concerning the Shipwrecked Vessel RMS Titanic (hereon referred to as the Titanic Agreement) is a component of the global oceans governance *cas*. The cultural and historical significance of the *Titanic* is described in more detail below, however, the Agreement's role as a 'part' of the global oceans governance *cas* (not withstanding the *cas* credo that the whole is much more than the sum of its parts), reflects the intent to protect features found on the ocean floor, be they shipwreck or hydrothermal vent field. An agreement already developed to protect shipwrecks is the Convention on the Protection of Underwater Cultural Heritage, adopted by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2001. Two provisions of the LOSC also afford some protection for underwater cultural heritage, although these provide only "a skeletal legal framework for the subject" (Dromgoole 2006, 2).

A number of key maritime states objected to the UNESCO Convention, including the UK and US. These states expressed their concerns regarding the extent of coastal state rights and the sovereign immunity of sunken state vessels and warships (Dromgoole 2006, 2). Nevertheless, the UK and US also recognised the need to provide protection for underwater cultural heritage sites irrespective of location and in response to growing international concern about the deteriorating condition of the RMS *Titanic* and ongoing activities at the site, negotiated an agreement with Canada and France to afford some legal protection for what remained of the wreck and its artefacts. Because the Titanic Agreement focuses on protecting a feature found on the ocean floor, it provides an ideal template for developing a high seas hydrothermal vent MPA.

The following section explores the Titanic Agreement within Jacobson and Brown Weiss' model for the implementation and compliance of an international environmental accord by framing it within:

- The characteristics of the activity involved;
- The characteristics of the accord;

– The international environment; and
– Factors involving the country.

The Characteristics of the Activity

In 1985, the wreck of the *Titanic* was discovered during a joint expedition by the French Research Institute for the Exploration of the Sea (IFREMER) and the Woods Hole Oceanographic Institute (WHOI) (US). Located approximately 325 nautical miles off Newfoundland in international waters at a depth of 3600 metres, the wreck had been lying there undisturbed since 1912 when she struck an iceberg during her maiden voyage from the UK to the US (Dromgoole 2006, 2). Robert Ballard (US) and Jean Luis Michael (France) were co-leaders of the mission that had been undertaken to test the deep water capabilities of a new type of exploration vehicle. Although the exploration team decided not to salvage any artefacts from the wreck or surrounds during the discovery voyage (Elia 2001), the technological advances inspired development of a lucrative deepwater salvage industry (Dromgoole 2006, 1). More than 6000 artefacts have since been recovered or salvaged from the wreck of the *Titanic* (UK Department for Transport 2004), and following the discovery, IFREMER entered into a contractual agreement with the private enterprise, Titanic Ventures, to salvage artefacts from the site. Titanic Ventures made 32 dives and recovered around 1800 artefacts from the debris field before selling its salvage rights and artefacts collection to RMS Titanic Inc. (Elia 2001).

Since the discovery of the *Titanic*, the artefacts and the wreck itself have been the subject of numerous legal challenges in the US regarding salvaging rights and ownership of artefacts. The US worked quickly to protect the shipwreck from any potential harm caused by erroneous salvage missions following its discovery. In 1985 a Bill was introduced into the US House of Representatives and referred to the House Committee on Merchant Marine and Fisheries for consideration. During the Committee hearings, Robert Ballard provided a witness statement that was to shape the US' approach to protection of the wreck (Dromgoole 2006, 3). He advised that the wreck was in "a high state of preservation" but vulnerable to interference and potential salvage operations

(Committee on Merchant Marine and Fisheries 1985, 19). Ballard's view was that the collection of artefacts located in the debris field (that is, the area around the wreck) should be allowed, but that the hull itself should not be entered or interfered with. He proposed the interior be recorded via remotely operated vehicle and a promotional film tour organised (Dromgoole 2006, 3).

Ballard's view held sway and with minor amendments the Bill was enacted by Congress as the RMS Titanic Maritime Memorial Act of 1986. The Act's declared purpose was to: (i) encourage international efforts to designate the RMS *Titanic* an international maritime memorial; (ii) to direct the US to enter into negotiations with other interested parties to establish an international agreement to this effect; (iii) to protect its cultural, historical and scientific significance; (iv) to encourage the development and implementation of international guidelines for undertaking research on, exploration of, and if appropriate, salvage of the RMS *Titanic*; and, (v) pending such guidelines or international agreement, that no US citizen could alter, disturb or salvage the RMS *Titanic* during any research or exploratory activities (Dromgoole 2006, 3). Nevertheless, in 1994 the Eastern District Court of Virginia named RMS Titanic Inc (RMST) exclusive salvor of items from the wreck. In 1996 RMST recovered another 74 objects. It also failed in its initial and highly publicised attempt to raise a 20 tone piece of the hull although it succeeded during a second attempt in 1998 (Elia 2001)

Factors affecting the Countries

The US entered into negotiations with the UK, Canada and France in 1997 because of a number of factors, the most important being that each country's flag vessels and nationals were already employing deepwater technology; their geographical proximity to the wreck; and the cultural, historical and scientific links each had with the RMS *Titanic.* The strongest links are between the UK and US – the vessel was British built, flew the British flag, sank on a voyage between Southampton and the New York, and many of the passengers were British or American, meaning the wreck itself represented a maritime grave site for the 1523 passengers and crew who perished during the disaster. Canada's primary link is geopolitical – the *Titanic* sank to the seafloor on Canada's continental shelf[88], while France's link is primarily scientific because of the involvement of INFREMER in the discovery of the wreck. The vessel also called into the French port of Cherbourg on its way to New York (Dromgoole 2006, 22 endnote 19).

The International Environment

The US led the development of draft texts, and by 2000 a final version had been agreed, although the process of bringing the Agreement forward for signature was delayed for several years because of legal battles over salvage and property rights in the US court system. The US National Oceanographic and Atmospheric Administration (NOAA) published the *Titanic Guidelines on the Research, Exploration and Salvage* in 2001 (NOAA Office of the General Counsel 2010). The UK Department for Transport released a public consultation document seeking comments on implementation of the Agreement (Dromgoole 2006, 5). Following strong support for implementation, the Titanic Agreement was signed by the UK on 6 November 2003. Primary implementing legislation was not required in the UK because the Merchant Shipping and Maritime Security Act 1997 includes a provision enabling the implementation of international agreements for the protection of wrecks beyond territorial waters by statutory instruments. The Protection of Wrecks (RMS Titanic) Order 2003 gives effect to the Titanic Agreement and will come into force when the US has enacted implementing legislation and deposited its instrument of acceptance (Dromgoole 2006, 13 and endnote 98).

The United States Department of State signed the Titanic Agreement on 18 June 2004 on behalf of the United States and a proposal of implementing legislation was transmitted to Congress on 24 July 2007 (United States Department of State 2004a; NOAA Office of the General Counsel 2010). Although France and Canada have not yet signed, it is anticipated they will. The ultimate aim of the Agreement is to encourage other states to become parties, including those countries whose nationals use deepwater

[88] Canada ratified the LOSC in 2003 and has until 2013 (ten years from the date of ratification) to make a submission regarding the outer limits of the Canadian continental shelf to the United Nations Commission for the Limits of the Continental Shelf (Foreign Affairs and International Trade Canada 2009).

technology such as Japan and Russia, and Ireland because of its cultural ties and geographical proximity (Dromgoole 2006, 5).

It is unclear how 'protective' the Titanic Agreement will be. Ballard revisited the site in 2004, reporting upon his return that while there was irreversible damage, there still remained much to protect. In addition to the removal of over 6000 artefacts, the manoeuvring of submersibles has had a significant impact on the hull, and many features of the ship have collapsed or disappeared. It is also believed that the natural biological and chemical processes of degradation have been hastened by human activity. Nevertheless, the Titanic Agreement is considered "a vital – if extremely belated – legal tool for achieving...protection", although "it is still by no means certain it will enter into force" (Dromgoole 2006, 20). Its success depends on the political will of Parties, their willingness to implement and comply with its provisions, and the cooperation of other States whose flag vessels and nationals have the technological capacity to access the site (Dromgoole 2006, 21).

The Characteristics of the Agreement

The Titanic Agreement contains a number of preambular clauses, 12 articles and an annex, the latter comprising "rules concerning activities aimed at the RMS *Titanic* and/or its artefacts" (Dromgoole 2006, 5-6; US Department of State 2004b). The rules derive from the International Council on Monuments and Sites (ICOMOS) Charter on the Protection and Management of Underwater Cultural Heritage adopted in 1996. The ICOMOS Charter imposes internationally- accepted professional archaeological standards for protected wrecks (Dromgoole 2006, 6).

The preamble recognises that *in situ* preservation is the most appropriate way to ensure protection of the RMS *Titanic* and its artefacts for the benefit of present and future generations "unless otherwise justified by educational, scientific or cultural interests, including the need to protect the integrity of RMS *Titanic* and/or its artefacts from a significant threat" (US Department of State 2004b). The preamble also refers to the relevant provisions of the 1982 LOSC, including Article 303 which addresses archaeological and historical objects found at sea and the duty of States to protect them (Dromgoole 2006, 17; US Department of State 2004b).

Article 1 provides definitions for the purpose of the Agreement. Article 2 dedicates the RMS *Titanic* as a memorial to those who died and whose remains should be afforded appropriate respect. Article 3 asks Parties to "take all reasonable measures to ensure that all artefacts recovered from the RMS *Titanic* after entry into force of this Agreement... are kept under its jurisdiction, are conserved and curated consistent with the relevant Rules and are kept together intact as project collections" (US Department of State 2004b).

Article 4 sets out provisions regarding flag state authority and responsibility for regulations through a system of project authorisation for entry into: (i) the hull sections of the wreck to ensure neither the hull nor the artefacts within are disturbed[89]; and (ii) activities aimed at the artefacts from RMS *Titanic* found beyond the hull so that all activities are, to the maximum extent practicable, conducted in accordance with the Rules[90]. Again, the import of *in situ* preservation is stated, as is the stipulation that recovery or excavation of the wreck and its artefacts should be granted only when justified by education, scientific or cultural interests[91]. No party shall authorise, award or grant exclusive salvage rights to the RMS *Titanic* or its artefacts in its vicinity that would preclude non-intrusive public access consistent with the Agreement. Further, each party is to take appropriate actions with respect to its nationals and flag flying vessels to enforce the measures it has taken in accordance with the Agreement[92], [93] (US Department of State 2004b).

Article 5 requires that each Party inform other Parties of the measures it has introduced

[89] Article 4.1 (a)
[90] Article 4.1 (b)
[91] Article 4.2
[92] Article 4.4
[93] In accordance with Article 4.4 of the Titanic Agreement, Article 6 of the UK Order lists a series of criminal offences committable under the Order, with the nature of the penalties that can be imposed "limited by the enabling statute to a fine of up to £5000 upon summary conviction, or an unlimited fine upon conviction on indictment" (Dromgoole 2006, 14-15).

to implement the Agreement[94] and provide copies of requests for authorisations for new projects made in accordance with Article 4 for comment by other Parties together with their preliminary views on the request.[95] Each Party is to inform other Parties of the written authorisations or denials it issues with respect to new projects as well as any amendments to previously issued project authorisations.[96] Parties are also to consult with a view to harmonising the regulation of activities undertaken by nationals or vessels subject to flag jurisdiction of more than one Party[97], and to harmonise enforcement actions in regard to activities conducted in contravention of the Agreement by nationals or vessels subject to flag jurisdiction of more than one Party.[98]

Article 8 sets out the dispute mechanism requiring Parties to consult among themselves with a view to resolving the dispute through negotiation or other mutually agreed peaceful means.

Article 9 reinforces the primacy of the 1982 LOSC in respect to the rights, jurisdiction and duties of States under this international law, and that present and future claims and legal views of any State concerning the law of the sea or the future development of international law regarding underwater cultural heritage should not be prejudiced.

Article 10 sets out the provisions for consent to be bound by the Agreement, namely:

(a) signature, without reservation as to ratification, acceptance or approval;

(b) signature followed by ratification, acceptance or approval; or accession.

Article 11 (2) states that the Agreement shall enter into force on the date on which two States have indicated their consent to be bound in accordance with Article 10, and that thereafter, the Agreement shall enter into force for a State on the date that State has indicated its consent to be bound in accordance with Article 10.

[94] Article 5.1
[95] Article 5.2
[96] Article 5.3
[97] Article 5.4
[98] Article 5.5

Article 12 enables any Party to denounce the Agreement by providing written notification to the Depositary, with denunciation taking effect six months after the date of receipt of the notification, unless a later date is specified.

Article 13 identifies the Government of the United Kingdom of Great Britain and Northern Ireland as the Depositary.

The Annex sets out 13 clusters of rules (see Box 1). These provide an ideal political framework within which to develop a high seas MPA prototype, that is, the annex sets out de facto standards which can guide attention toward what can be achieved by innovative leaders (in this case, the US), and perhaps what can be achieved by the relevant 'others' in the global oceans governance *cas*. As highlighted in an earlier section of this chapter exploring the managerial relevance and natural appropriateness of small scale environmental agreements through the lens of the implementation and compliance model (Jacobson and Brown Weiss 1998), the often highly technical nature of environmental accords and the dynamic economic and scientific environment in which they exist means they need to include provisions for gathering and using scientific and technical advice. There also needs to be broad consensus among parties regarding scientific and technical issues (Jacobson and Brown Weiss 1998, 525), and a shared respect for the sources of information that are used to inform decisions.

Requiring parties to report regularly on policies and regulated activities adopted at the domestic level represents one of the few opportunities available for evaluating the extent of implementation and compliance (Jacobson and Brown Weiss 1998, 525), and the efficacy of the agreement itself. As Hall and Haward note, this process also engenders a more disciplined approach among parties (2000, 186). File sharing among parties is also critical, enhancing as it does the equitable nature of the accord and improving the intellectual capital that the accord itself may generate. The Annex to the Agreement Concerning the Shipwrecked Vessel RMS Titanic sets out a simple set of rules that describe dissemination of information, project design, funding security, circulation of project plans, reporting mechanisms, conservation requirements, professional expertise in project execution and safety requirements, all of which contribute substantially to the internal and external legitimacy of the Agreement. The rules prescribed in the Agreement's Annex are particularly appropriate for the development of a hydrothermal vent field MPA prototype. To reiterate an important point made earlier in this chapter, a prototype field tested successfully in one context tends to moderate political opposition to action in others (Lasswell and Kaplan 1950, 113). Depending on how one defines success in this instance, it could be argued that in the geopolitical sense, it has succeeded on a number of planes, primarily that of acknowledging the need to protect the wreck of the RMS *Titanic* as a maritime graveyard and memorial to those who perished, and the capacity to reach agreement between relevant parties (quality over quantity).

Summary of the Titanic Agreement

The Titanic Agreement is a managerially relevant and naturally appropriate instrument for protecting the wreck and artefacts of the vessel, especially when one takes into account the factors affecting the countries involved, the characteristics of the activity, and the international environment that led to the development of the Agreement. It was inspired by a highly respected and professionally qualified opinion leader – Robert Ballard – who was directly involved in the discovery of the wreck and artefacts, and whose views on its protection influenced the direction of US policy in relation to the RMS *Titanic.*

It fits with the conventional wisdom (at least in principle) that the smaller the number of actors involved in the activity, the easier and more cost effective it is to reach an agreement and to control the actions of nationals and flag vessels of Parties to the agreement (Olson 1968; Hall and Haward 2000, 185). The burden of compliance rests with a manageable number of actors and targets those directly involved with the activity (Jacobson and Brown Weiss 1998, 523, 552).

Box 1: Annex – Rules Concerning Activities Aimed at the RMS Titanic and/or its Artifacts (US Department of State 2004b).

RULES CONCERNING ACTIVITIES AIMED AT THE RMS TITANIC AND/OR ITS ARTIFACTS (US Department of State 2004b).

I. General Principles

1. The preferred policy for the preservation of the RMS *Titanic* and its artifacts is *in situ* preservation.
2. Activities shall avoid disturbance of human remains.
3. Activities utilizing non-destructive techniques and non-intrusive surveys and sampling shall be preferred to those involving recovery or excavation aimed at RMS *Titanic* and/or its artefacts.
4. Activities shall have the minimum adverse impact on RMS *Titanic* and its artefacts.
5. Persons undertaking these activities shall ensure proper recording and dissemination to the public of historical, cultural and archaeological information.

II. Project Design

6. Activities shall be the object of a project design that shall include:
    a. the objectives of the project;
    b. a general description of the methodology and techniques to be employed;
    c. a description of the anticipated funding;
    d. a provisional timetable for completion of the project;
    e. the composition, qualifications and responsibilities of the anticipated team;
    f. the proposal for or results of all preliminary work;
    g. if applicable, plans for post-fieldwork;
    h. if applicable, a conservation and curation plan;
    i. a documentation policy;
    j. a safety policy;
    k. if applicable, arrangements for collaboration with museums and other institutions;
    l. report preparation, contents and dissemination;

m. if applicable, the anticipated disposition of archives, including artefacts; and

n. if applicable, a program for publication.

7. If unexpected discoveries are made or circumstances change, the project design shall be reviewed and amended. Amendments to the project design shall require a new authorization to be issued.

8. Each project shall be carried out in accordance with its project design.

III. Funding

9. Projects shall be designed to ensure adequate funding in advance to complete all stages of the project including the curation, conservation and documentation of any recovered artefacts, and the preparation and dissemination of the report.

10. The project design shall include contingency plans that will ensure conservation of recovered artefacts and supporting documentation in the event of any interruption of anticipated funding.

11. The project design shall demonstrate an ability to fund the project through completion.

12. Project funding shall not require the sale of artefacts or other material recovered or the use of any strategy that will cause artefacts and supporting documentation to be irretrievably dispersed.

VI. Duration – Timetable

13. Adequate time shall be assured in advance to complete all stages of the project, including the curation, conservation and documentation of any recovered artifacts, and the preparation and dissemination of the report.

14. The project design shall include contingency plans that will ensure conservation of artifacts and supporting documentation in the event of any interruption in the anticipated timetable.

V. Objectives, Methodology and Techniques

15. The project design shall include the objectives, proposed methodology and techniques.

16. The methodology shall comply with the project objectives and with the general principles in section 1.

VI. Professional Qualifications

17. Projects shall only be undertaken under the guidance of and in the presence of qualified technical and/or professional experts with experience appropriate to the objectives. The project shall not commence until the identity, qualifications, experience and responsibilities of the team members have been notified to and approved by the relevant national authorities.
18. All persons on the project team shall be:
    a. qualified and have demonstrated experience appropriate to their project roles; and
    b. fully briefed and understand the work required.

VII. Preliminary Work

19. The project design shall include:
    a. an assessment that evaluates the vulnerability of RMS *Titanic* and artifacts to damage by the proposed activities; and
    b. a determination that the benefits of the project outweigh the potential risk of damage.
20. The assessment shall also include background studies and relevant bibliography of available historical and archaeological evidence, and environmental consequences of the proposed project for the long-term stability of RMS *Titanic* and artifacts.

VIII. Documentation

21. Projects shall be thoroughly documented in accordance with professional archaeological standards current at the time the project is undertaken.
22. Documentation shall include, at a minimum, the systematic and complete recording of the provenance of artifacts moved or removed in the course of the project, field notes, plans, sections, photographs and recording in other media.

IX. Artifact Conservation

23. The project design shall include a conservation plan that provides for the treatment of the artifacts in transit and in the long term.
24. Conservation shall be carried out in accordance with professional standards current at the time the project is undertaken.

X. Safety

25. All persons on the team shall work according to a safety policy prepared according to professional and legal requirements set out in the project design.

XI. Reporting

26. Interim reports shall be made available according to a timetable set out in the project design, and provided to relevant national authorities.
27. Reports shall include:
    a. an account of the objectives;
    b. an account of the methodology and techniques employed;
    c. an account of the results achieved; and
    d. recommendations concerning conservation of any artifacts removed during the course of the project.

XII. Curation of the Project Collection

28. The project collection, including any artifacts recovered during the course of the project and a copy of all supporting documentation, shall be kept together and intact in a manner that provides for public access, curation and its availability for educational, scientific, cultural and other public purposes.
29. Arrangements for curation of the project collection shall be agreed before any project commences, and shall be set out in the project design.
30. The project collection shall be curated according to professional standards current at the time the project is undertaken.

XIII. Dissemination

31. Projects shall provide for public education and popular presentation of the results.

A final synthesis shall be provided to relevant national authorities and made available to the public as soon as possible, having regard to the complexity of the project.

In relation to the characteristics of the Titanic Agreement, its rules are equitable and simple (although their precision and clarity have been questioned - see Dromgoole (2006) for a comprehensive analysis of the clarity of the Annex rules). There are provisions for gathering and using scientific and technical advice, together with reporting mechanisms, dissemination of information including project proposals, file sharing to facilitate intellectual capital, and funding rules to ensure financial confidence that projects can be undertaken and completed.

The Agreement is legitimate in the sense that Parties perceive “that the rule or institution has come into being and operates in accordance with general rules of right process” (Frank 1990), and it is internally applicable, as demonstrated by the UK’s decision to sign and implement the Agreement in 2003. It is a relevant and externally legitimate document that aligns with significant developments in the international community following the discovery of the wreck and ensuing concerns about its *in situ* preservation.

The Endeavour Hydrothermal Vents Marine Protected Area

Background

Located 250 kilometres southwest of Vancouver Island (off the coast of British Columbia), the Endeavour Hydrothermal Vents MPA (hereon referred to as the Endeavour MPA) is located at a depth of 2,250 metres in the Pacific Ocean. Part of the Juan de Fuca Ridge system, the Endeavour segment is an active seafloor spreading zone where new oceanic crust is formed when tectonic plates diverge (Canada Gazette 2003, 4).

The MPA is a 100 square kilometre area of ocean floor and superjacent water column, the latter also considered an integral part of the vent ecosystem. The vents in the Endeavour area comprise clusters of large black chimney-like smokers formed when particles contained in the plumes are expelled from fissures in the seafloor and harden on contact with the cold seawater. The plumes themselves are expelled at temperatures of around 300º Celsius. They rise rapidly to approximately 300 metres above the seafloor, warming the waters surrounding the vents when expelled but cooling as they rise (Canada Gazette 2003, 5).

The Endeavour Hydrothermal Vents area “represents a unique habitat that is considered the most biologically productive and diverse hydrothermal vent site along the Juan de Fuca Ridge” (Canada Gazette 2003, 4). The super-rich waters around the vents host animal concentrations of up to half a million per square metre. There are around 60 distinct species native to the Juan de Fuca Ridge and 12 species endemic to the Endeavour vents area. The waters beyond the MPA area are much less biologically productive, decreasing to organism densities of approximately 20 species per square metre (Canada Gazette 2003, 5-6).

The remoteness, depth and distance of the Endeavour vent system limits access to those with the technological capacity and resources to reach the area. There is little impact by surface shipping traffic or fishing activity. Domestic fishing vessel access is managed under the provisions of Canada's *Fisheries Act*. The mining industry had previously expressed interest in the resource potential of the area, although preliminary research in 2001 indicated that the sulphide tonnages were very small and therefore not worth the significant investment in extraction technology that would be required. Prospects for gas and oil exploration in the MPA are negligible because of seismic activity, the thin oceanic crust and the economic infeasibility of extraction, factors which also discourage marine cable installation in the area. The key danger to the Endeavour ecosystem is the potential for flora, fauna and habitat degradation via physical damage to the vent structures (Canada Gazette 2003, 5-6, 9).

The most active sector involved in the Endeavour vents is that of scientific research with several expeditions undertaken each year. Because of the prohibitive cost of research at hydrothermal vent systems, scientific knowledge about their ecosystem structures and geological factors remains limited (Canada Gazette 2003, 8). As discussed in Chapter Two, however, hydrothermal vent systems have enormous natural laboratory values and the Endeavour vents are no exception.

The Endeavour Hydrothermal Vents were declared a candidate MPA in December 1998. An extensive and thorough process of stakeholder consultation followed and the area was declared an MPA in 2003 under the provisions of Canada's *Oceans Act.* In addition to a suite of regulations, a Management Plan was developed in collaboration with stakeholders to ensure conservation objectives could be met. The Management Plan describes:

- provisions for authorising access to the area;
- an observer program;
- requirements for marine environmental documentation;
- development and implementation of an education and outreach program to share research information; and
- the roles and responsibilities of the multi-sector management committee that oversees the Plan (Canada Gazette 2003, 6).

Endeavour Hydrothermal Vents Marine Protected Area Regulations
Section 1 of the Regulations describes the area of the Pacific Ocean – the seabed, subsoil and superjacent waters – designated a marine protected area (Canada Gazette 2003, 1).

Section 2 sets out what is prohibited within the designated area. Section 2(a) prohibits the disturbance, damage, destruction or removal of venting structures, any part of the subsoil, or any living marine organism or part of its habitat. Section 2(b) prohibits any underwater activity that results in the impacts described in 2(a) (Canada Gazette 2003, 1).

Exceptions to the provisions of 2(a) and 2(b) are outlined in Section 3(1)(a), which exempts damage, disturbance, destruction or removal for scientific research contributing to the conservation, protection and understanding of the Area. Section 3(1)(b) requires a research plan to be submitted to the Minister at least 90 days prior to the start of a scientific research expedition in the Area, and 3(1)(c) addresses the requirement for all relevant licences to be obtained before the research expedition can proceed (Canada Gazette 2003, 2).

Section 3(2)(a-d) describes the information required for the research plan, including names, nationalities and position descriptions of all those on board, vessel details, the date of commencement of the expedition, the ship itinerary, a summary of the scientific research to be conducted in the Area including the data to be collected, sampling protocols, details of other techniques and technologies to be used such as remotely operated vehicles, explosives or radioactive labelling, the equipment that is to be moored and the method of mooring, and the substances, if any, intended for discharge. Section 3(3) states that a research plan is not required to be submitted under paragraph (1)(*b*) if the information required under subsection (2) has previously been submitted in writing to obtain consent under the *Coasting Trading Act* to conduct the scientific research. Section 3(4) requires that any changes to the research plan be conveyed immediately to the Minister (Canada Gazette 2003, 2).

Section 5 states that no person contravenes section 2 by carrying out an activity in the Area that comes under relevant regulatory and licensing provisions of the *Fisheries Act*, *Coasting Trade Act*, the *Oceans Act*, or the *Coastal Fisheries Protection Act* (Canada Gazette 2003, 2- 3).

Section 5 (a) and 5(b) describe activities that do not contravene Section 2, including any activity carried out for the purpose of public safety, law enforcement or Canadian sovereignty or national security, and vessels under the command or control of the Canadian Forces, or foreign military vessels acting in cooperation with the Canadian Forces (Canada Gazette 2003, 3).

Compliance and Enforcement

The basis for protection of the Endeavour Hydrothermal Vents area is formed by its designation as an MPA and prohibition of disturbance or damage to the unique ecosystem.

The compliance and enforcement mechanisms that underpin the regulations and management plan are set out as follows:

> Licences and authorizations under the *Fisheries Act* and the *Coastal Fisheries Protection Act*, clearance consents issued via the Foreign Vessel Clearance Request process under the *Coasting Trade Act*, and the research plan provisions of this Regulation will manage access to the MPA and the conditions of such

> access for domestic and foreign vessels. DFO[99] has developed a referral process for access requests to the Endeavour Hydrothermal Vents MPA so that the management committee can ensure consistency with the conservation objectives and management plan for the MPA. Compliance will be monitored via the observer program and cruise reports requested under the Foreign Vessel Clearance Request Process (Canada Gazette 2003, 14).

Violations of the Endeavour MPA regulations "carry penalties under the *Oceans Act*, while contraventions of access authorizations and licences can result in charges under the *Fisheries Act* and under the *Coasting Trade Act.* Upon conviction, courts may impose fines and prison terms for offences under each of these Acts" (Canada Gazette 2003, 14).

Summary

As the Endeavour MPA is located in Canadian waters, there is no need to examine it within Jacobson and Brown Weiss' implementation and compliance framework for international environmental accords. It does, however, provide a model for the geophysical and biological elements to be taken into account in the development of a high seas hydrothermal vent MPA prototype. It also has a number of characteristics in common with the Titanic Agreement, namely the submission of a research/project plan, details of people and vessels involved, and the sharing of information and knowledge following research expeditions, including a post-expedition report.

The Endeavour MPA introduces some other important factors to be taken into consideration in development of a high seas hydrothermal vent MPA, including the remoteness, depth and distance of vents fields and systems and how these characteristics act as self-protecting mechanisms, important vent-specific details to be included in research plans, and the importance of the vent structures, density of marine life, and importance of the water column in vent ecosystem functioning.

[99] Fisheries and Oceans Canada goes by the acronym of DFO.

The WWF Proforma for compiling the characteristics of a potential MPA (the Rainbow Hydrothermal Vent proposal)

Characteristics of the Proposal

In its capacity as a change agent, WWF submitted its *Proforma for compiling the characteristics of a potential MPA* for consideration by OSPAR in March 2005 with revisions made in October 2005 and again in January 2006, the latter taking into account comments received from the European Commission and Germany (WWF 2006). The potential MPA that WWF is promoting is the Rainbow hydrothermal vent field which is located 45 nautical miles outside the EEZ of the Azores (Portugal) and beyond the limits of any coastal states of the OSPAR Maritime Area. The proposed protected area delimitation is 360 square nautical miles and is situated on a section of the Mid Atlantic Ridge considered part of the Portuguese Continental Platform. Portugal initiated a procedure toward delimiting its legal Continental Shelf in 2005[100] (WWF 2006).

The Proforma comprises three sections. Section A provides general information about the Rainbow hydrothermal vent area under the headings of:

1. Proposed name of MPA;
2. Aim of the MPA:
    - Prevent degradation of, and damage to species, habitats and ecological processes following the precautionary principle;
    - Protect and conserve areas that best represent the range of species, habitats and ecological processes in the OSPAR area.
3. Status of the location (according to the maritime area boundaries defined in the 1982 LOSC).
4. Marine region – OSPAR Region V, Mid Atlantic Ridge, SW of Azores. BioGeo Code 17, Azores Subprovince, 20 hydrothermal vents/fields > 250ºC.

[100] Portugal's submission to the United Nations Commission on the Limits of the Continental Shelf is under consideration and the Commission will make recommendations pursuant to Article 76 of the LOSC following its 25th session in 2010 (United Nations Division for Ocean Affairs and the Law of the Sea (UNDOALOS 2010).

5. Biogeographic region – Atlantic Realm; Atlantic Subregion; North Atlantic Province.
6. Location (coordinates for the proposed site, together with bathymetric maps)
7. Size: 15 x 24 nautical miles (360 square nautical miles)
8. Characteristics of the area, including year of discovery (1997), substrate description and geomorphology; plume details (temperature range, metal concentrations, pH); species number (32 different species have been recorded thus far), faunal composition, age structure and abundance, species assemblage according to vent age, current human activities (primarily scientific research although some research expeditions have been funded by allowing tourists on board), and potential threats imposed by scientific research (WWF 2006).

Section B of the Proforma outlines Selection Criteria according to (a) ecological criteria/considerations; and (b) practical criteria/considerations. Subsection (a) covers:

1. Threatened and declining species and habitats: The proposal is based on the precautionary principle as there is no evidence suggesting any current significant threat to habitat or decline in species.
2. Important species and habitats: Chemosynthetic biological communities; chemoautotrophic bacteria that form the basis of the trophic structure; shrimps, mussels, crabs and polychaetes (see Chapter Two for a detailed description of species that have adapted to, and thrive in, hydrothermal conditions).
3. Ecological significance: Hydrothermal vent fields occur in some, but not all parts of the Mid Atlantic Ridge, mostly within coastal states' jurisdictions. The Rainbow vent field is one of a group of northern vent fields that also includes Saldanha, Famous, Lucky Strike and Menez Gwen. Rainbow is the southern-most vent in this group. Each vent field within the northern group is unique, and the group itself differs from vent fields found in southern, deeper waters outside the OSPAR area. WWF concludes that "the ecological setting at Rainbow is unique globally and in the OSPAR area" (WWF 2006). It also hosts a rich

biomass and density of specialised megafauna, including bresiliid shrimps and mussel ‘mats’.

4. High natural biological diversity: Hydrothermal vents are not recognised as areas of high biodiversity. Slow spreading ridges such as the Mid Atlantic Ridge represent relative high species diversity however there is insufficient empirical evidence to suggest that a comparatively high level of biological diversity is found at the Rainbow vent field.
5. Representivity: The WWF proforma claims that while “the Rainbow vent field is a geologically and ecologically particular site, it is overall representative of highly dynamic sulphur-containing hydrothermal vents with highly variable community densities” (WWF 2006).
6. Sensitivity: The high endemicity and small spatial extent of vent fields, together with their ephemeral nature, render them highly sensitive to commercial exploitation and uncontrolled scientific exploration, including the impacts of substrate and species sampling, the risk of unintended species transfer between vents within a field, and the movement of submersibles. There is however, insufficient evidence regarding species’ sensitivity to these variables. Chapter Two describes in detail existing and potential anthropogenic impacts on hydrothermal vents.
7. Naturalness: This criterion rates the natural condition of the proposed MPA. In the case of the Rainbow vent field, WWF rates it “[p]robably high” (2006).

Subsection (b) – Practical criteria/considerations – identifies:

1. Potential for restoration. This criterion addresses the need and potential for restoration should the site not be in a pristine state.
2. Degree of acceptance. This is the degree of stakeholder acceptance/political legitimacy and covers scientific research, tourism, bioprospecting, mining, fisheries, transport, and cable laying.
3. Potential for success of management measures is based on the degree of acceptance, that is, if measures can be agreed and accepted then management objectives can be developed and implemented.

4. Potential damage to the area by human activities covers the potential for damage by the stakeholder groups identified in Subsection (b)(2).
5. Scientific value. The Rainbow hydrothermal vent field is identified as a site of high scientific value, with one researcher suggesting that it may be more relevant to studies of the origins of life than any other vent site yet discovered along the ridge crest (German 2002; WWF 2006).

Summary and Analysis of the WWF Proforma for the Rainbow Hydrothermal Vent Field MPA

With the exceptions of (a)(4) *high biological diversity* and (a)(5) *representivity*, the WWF proforma provides a sound mix of criteria to be taken into account when considering candidate hydrothermal vent fields for potential MPA status. An analysis of the concept of *representivity* in the context of the high seas epistemic community's primary tag (*a global representative system of MPAs by 2012*) was presented in Chapter Six of this thesis. To recap, representative habitats are described "by ecosystem level structures - primarily enduring geophysical features - and recurrent processes" (Roff and Evans 2002). The properties of a representative habitat can be hierarchically ranked and mapped to include the entire environment within a region (Roff and Evans 2002). A representative MPA, therefore, is a demarcated area of a typical habitat that is afforded some degree of protection from human activities in order to gauge physical and/or biological processes which can then be compared with the unprotected portion of the habitat or with similar or same habitats elsewhere. In relation to substrate type and geomorphology, the Rainbow hydrothermal vent field is characterised by large spire edifices and hundreds of small chimneys interspersed with inactive and short-lived active venting sites. The substrate differs from neighbouring fields and many others known on mid-ocean ridges (the Rainbow hydrothermal vent field is situated on ultramafic substrate exposed by large scale faulting) (WWF 2006). This information, together with WWF's description of Rainbow's ecological significance in selection criterion (a)(3) and high natural biological diversity ((a)(4)) indicates that there is little if anything 'typical' at the Rainbow hydrothermal vent field, either geophysically or ecologically.

High biological diversity is frequently identified as a key conservation criterion. Baker et al (2001, 6) raise an interesting and valid point in relation to relative values of high and low species diversity. They note that the argument for or against protection of areas of high biological diversity is usually framed by socio-economic values as the potential for resource exploitation is significantly greater in areas of high biodiversity than in those of low biodiversity, and that as such, areas of high biodiversity are more worthy of protection. Areas that host highly diverse and complex biological communities may, however, prove less resilient to natural and anthropogenic impacts than those of low biological diversity and as such it could be argued that the latter are more 'worthy' of protective measures. The thrust of Baker et al's argument is that conservation and protection criteria need to be framed in the broader context of ecosystem functions, services and species resilience rather than ranking habitats or areas as worthy of conservation according to a quantitative assessment of *in situ* or transitory biological diversity (Baker et al 2001, 6). In the context of hydrothermal vent systems, for example, which have low biodiversity but significant and highly specialised species biomass, the case for protection cannot, or rather should not, be framed according to the extent of biological diversity found on site.

Conclusion

The evidence, theory and arguments presented throughout this and the previous chapter support the assertion that a prototype high seas hydrothermal vent MPA offers a more pragmatic and achievable building block for the development of high seas MPAs and stands in stark contrast to the high seas epistemic community's primary goal of *a global representative system of MPAs by 2012.* A prototype high seas MPA represents a proposal which will be perceived as being "*managerially relevant* and *naturally appropriate*" (Norton and Ulanowicz 1992, 247 original emphasis). Prototypes are innovations, "typically small scale, made in political practice for scientific purposes" (Lasswell 1963, 98). They provide means of discovering and developing "newly emerging patterns of institutional life" (Lasswell 1963, 105).

A primary building block for application of prototypes is that the concept should appeal to others on their own terms. Jacobson and Brown Weiss' research leading to the development of their Implementation and Compliance Model confirmed the conventional wisdom that the smaller the number of actors involved in the activity, the easier and less resource-intensive it is to reach agreement and control the actions of parties (Olson 1968; Hall and Haward 2000, 185). If, for instance, Japanese, German, US and Russian researchers are studying a particular vent site, whether for scientific or commercial purposes, then it is these countries that should be targeted as signatories to an agreement to protect the fauna and geomorphology of that site. Why involve states that do not undertake deep ocean research? It is little wonder there is international resistance to high seas MPAs when the concept is embedded in a macro-goal together with calls for a global treaty or implementing agreement to the 1982 LOSC, as discussed in Chapter Five. An informal accord on the other hand allows for flexibility, minimises impediments to cooperation at both the domestic and international levels and can be finalised and implemented quickly if required, which is an advantage in a rapidly changing environment (Lipson 1991, 500-501).

The success or otherwise of a prototype, (innovation), is generated through diffusion and adaptation. As described in this chapter, the five critical attributes of innovation that inform the decision making processes of the potential adopter are (Rogers 1995, 15-16):

1. Relative advantage;
2. Compatibility;
3. Level of complexity (the more complex the innovation, for example, *a global representative system of MPAs by 2012*, the slower the rate of adoption, hence a prototype high seas MPA agreed among a small number of parties involved in a particular activity has a comparatively low level of complexity);
4. Trialability; and
5. Observability.

Table 9: Synthesis of elements which can be used to inform the development of a prototype high seas hydrothermal vent MPA.

Structure of the Agreement (Administrative Structure)	**Biophysical and Geophysical Details to include in the Prototype**	**Rules Regarding the Activity (Titanic Agreement Annex)**
Small number of actors involved in the activity (Titanic Agreement)	Marine and biogeographic regions Location and size Characteristics of the area (fauna, substrate, plume details, current human activities, potential threats) Important and threatened species Ecological significance Sensitivity (WWF Proforma)	General Principles Project design Funding Duration of activity/project Objectives, methodology and techniques Professional qualifications Preliminary work Documentation Artefact conservation Safety Reporting Curation of Project Collection Dissemination
Dispute mechanism (Titanic Agreement Article 8)	Geomorphic structure (Endeavour Hydrothermal Vent MPA)	
Primacy of the 1982 LOSC (Titanic Agreement Article 9)		
Regulations (Endeavour Hydrothermal Vent MPA Regulations)		
Name, aim and geopolitical status of the proposed high seas hydrothermal vent MPA (WWF Proforma)		

Jacobson and Brown Weiss' Implementation and Compliance Model provides four broad but inextricably linked categories of factors (generalisations) which can be used to inform the design of a prototype high seas MPA agreement:

1. The characteristics of the activity;
2. The characteristics of the accord;
3. The international environment; and
4. Factors involving the country.

Table 9 is a synthesis of elements drawn from the three models – the Titanic Agreement, the Endeavour Hydrothermal Vent MPA, and the WWF proforma for the Rainbow hydrothermal vent field – that can inform development of a prototype high seas hydrothermal vent MPA.

The complementarities between adaptation and prototyping also reacquaint us with the *cas* element of diversity. Diversity serves a distinct purpose in evolution and progression - as each adaptation takes place it generates potential for new interactions and creation of new niches. As Chapter Three pointed out, this phenomenon contributes to a *cas* characteristic termed *perpetual novelty* (Holland 1995, 27). Similarly, prototypes adapted to new circumstances may lead to diversification through the stimulation of new waves of innovation (diversifying the initial model and adapting the experiences to improve or restructure the model) within the system. At least initially, a high seas MPA prototype would introduce a perpetually novel element into the global oceans governance *cas*. As long as the problem or issue remains a priority (for example, if the protection of deep oceans biodiversity remains on the issue attention agenda of the global oceans governance *cas*), de facto standards can be crystallised through examples of protective mechanisms such as a 'successful' high seas MPA prototype. Success with the prototype will realise further commitment for additional resources to adapt and diffuse effective models (Lasswell 1963, 107-7; Brunner and Clark 1997, 55). The successful prototype will provide the global oceans governance *cas* with *empirical* evidence of organic or structural change. De facto standards guide attention toward what has been achieved by innovative leaders (opinion leaders and/or change agents), and perhaps what can be achieved by other actors in the *cas* (Brunner and Clark 1997, 55).

CHAPTER EIGHT

CONCLUSIONS

High Seas Marine Protected Areas: An 'idea whose time has come'?

The key primary question behind this body of research, as outlined in Figure 2, Chapter One, asks:

> *If high seas marine protected areas are indeed 'an idea whose time has come', what is the best means of achieving them?*

In order to answer this question, the thesis has presented a series of arguments underpinned by the complex adaptive systems (*cas*) paradigm which offers tools and insights for analysis of high seas marine protected area discourse, the global oceans governance system in which this discourse takes place, and the key actors proposing spatially demarcated areas of protection in waters beyond national jurisdiction.

A key point made in this thesis is that the post 1972 era of international environmental diplomacy has engendered a tendency for big pictures, grand ambitions and grander visions or 'macro-goals'. Emerging out of global oceans governance component of this environment is a high seas epistemic community with a key message – the achievement of high seas MPAS – through its primary tag of *a global representative system of MPAs by 2012*. The primary tag forms part of the eco-ethical ideological priority social goal of protecting oceans biodiversity.

The primary tag has attracted like-minded agents and provided context for the community in its mission to protect the biodiversity of oceans beyond national jurisdiction. As identified in the preceding chapters, however, numerous paradoxes, limitations and challenges inherent in employing such an ambitious primary tag within which to embed the concept of high seas MPAs. Over time, the tag has moved from having a multiplier effect in relation to flows of information and attracting like minded agents, to that of recycling through repetition with little uptake of new agents and challenging ideas to reinvigorate debate. Quite simply, it has become stale.

Another key argument made in this thesis is that the approach that the high seas epistemic community has taken has realised a perverse outcome – that the primary tag of *a global representative system of MPAs by 2012* has set a precedent for the development of high seas MPA models through expectations that they be representative, preferably part of an MPA network, and embedded in a global system to be achieved by a specified time. When an existing model is predicted to produce outcomes acceptable to proponents of a concept or ideology, there is little incentive to adopt a critical perspective or search for alternative means of understanding a problem. When agents become ideologically immutable, they also become more vulnerable; the challenge lies in the agent maintaining its relevancy and legitimacy in a dynamic environment where other agents are adapting and changing in order to survive. Survival of the fittest applies to all agents in any type of system therefore for an idea or an agent to remain integral to the system itself, it must be open to all types of information, prepared to adopt a critical perspective, and seek alternative means of tackling the problem to adapt to the dynamic environment in which it exists.

The scope and temporal objective of the *global representative system of MPAs by 2012* seems to have put this goal beyond reach. The semantic deconstruction of the concepts of *representativeness* and *networks* revealed numerous contradictions and impracticalities, and the linearity of the primary tag is self-defeating. The upshot is that advocacy groups need to analyse, evaluate and understand what it is they are promoting.

It has also been argued that the high seas epistemic community's 'fit' in the global oceans governance *cas* is tenuous at best when it persists in promoting fixed, linear and finite goals in a systemically dynamic and adaptive environment. To encourage some practical action toward the creation of high seas MPAs, the high seas epistemic community would be better served by becoming more diverse in its membership and opening its feedback loops to flows of information, ideas and opinions that challenge its current high seas MPA discourse. Likewise, the ‘higher level’ institutions in the global oceans governance *cas* hierarchy might also benefit from revisiting and analysing the macro-goals that have become *de rigueur* in discussions concerning the protection of high seas biodiversity – the persistent use of the primary tag being a prime example – and open up their information nodes to a freer flow of ideas and challenges.

This thesis offers an alternative to the macro-goal approach, another avenue through which the high seas epistemic community might channel its energy and resources – a prototype high seas MPA based on an informal agreement among a small number of countries involved in a high seas activity, countries with the political will and technical capacity to ensure the actions of their citizens do not impact negatively on the deep oceans biodiversity.

Research Questions

The following is a summary of the chapters that addressed each of the research questions listed in Chapter One of this thesis.

What is found in areas beyond national jurisdiction and why might some of these features require protection?

Chapter Two provided details of the geomorphology, geology, biology, current and future threats and extant regulatory instruments and measures intended to protect or reduce damage to deep oceans features and biodiversity in areas beyond national jurisdiction. There is a great deal of concern about the damage inflicted on seabed geomorphic features by bottom trawling, and sound ecological arguments have been mounted by the high sea epistemic community for internationally agreed protection of seamounts and cold water corals which harbour large numbers of commercially valuable species. Political and commercial realities indicate, however, that these deep ocean habitats may not be ideal candidates for the world’s first high seas marine protected areas. Indeed, declaring a pristine seamount environment the world’s first high seas marine protected area prototype may have the unintended consequence of alerting illegal, unregulated and unreported (IUU) fishers to healthy populations of commercial fishstocks and the prospect of significant financial gain.

On the balance of evidence regarding current and future threats, ecosystem properties, levels of endemicity, ecosystem functions, goods and services, and political realities, a hydrothermal vent system was identified as the ideal prototype for spatially demarcated protection of geomorphic features located in areas beyond national jurisdiction. Vent systems are, for the most part, ephemeral pristine deep sea ecosystems with a critical role in the chemical composition of the oceans. They are isolated biological islands with highly specialised fauna that have adapted to extreme physical and chemical conditions. Some are the locus of intense marine scientific research as well as sirens of the deep for marine mining and biotechnology companies. With these factors in mind, a high seas hydrothermal vent system represents an ideal candidate for a prototype marine protected area, a concept which was examined in greater detail in Chapter Seven.

What theory is ideal for exploring the global oceans governance system and the high seas epistemic community and analysing high seas MPA discourse?

The most appropriate systems view of global oceans governance is that of the complex adaptive systems (*cas*) paradigm. Global oceans governance exhibits the four cornerstones *of cas – adaptation*, *emergence, self-organisation*, and *hierarchy* (Holland 1995). The *cas* paradigm paints a colourful backdrop and provides a suite of metaphors – (i) aggregation; (ii) tags and tagging; (iii) non-linearity; (iv) flows; (v) diversity; (vi) internal models; and (vii) building blocks – for analysis of high seas MPA discourse and its key agent, the high seas epistemic community.

Chapter Three established that a complex adaptive system is a hierarchical, self-organised, emergent and adaptive entity that functions according to its own set of rules and strategies. The dynamic nature of complex adaptive systems means that the behaviour of the whole cannot be understood by the sum of its parts. The dynamics of a *cas* – its topology, environmental influences, the characteristics of the agents within the system, and the system itself – demand constant behavioural adaptations of its agents in action settings. Complex adaptive systems are neither static nor balanced – instead, they are in a state of perpetual novelty.

The high seas epistemic community is itself a hierarchical and self organised subsystem nested within the larger global oceans governance cas, although as proposed in Chapter Six, its capacity for adaptation and emergent behaviours seems to be diminishing somewhat, bound as it is to the linear and temporally finite tag of a global representative system of MPAs by 2012. The physiology of the global oceans governance *cas* is best understood by exploring the connectivity – the relationships – between its parts rather than analysing each part in isolation (Gallagher and Appenzeller 1999, 79). The *cas* paradigm proved invaluable in terms of framing this exploration. As described in Chapters Four and Five, over time these patterns of interactions have manifested in emergent phenomena that are observable at the macro-level even though they are generated by agents at the micro-level (Seel 1992, 2; Parvard and Dugdale 2005).

Who is driving high seas MPA discourse and how has the concept been promoted?

The high seas epistemic community was identified as the ideological impetus behind high seas MPA discourse within the global oceans governance *cas* and its primary tag of *a global representative system of MPAs by 2012* is embedded in the community's broader priority social goal of promoting the protection of oceans biodiversity. The seven basics of *cas* – (i) aggregation; (ii) tags and tagging; (iii) non-linearity; (iv) flows; (v) diversity; (vi) internal models; and (vii) building blocks – were the metaphors employed in this thesis for describing and analysing the high seas epistemic community's goal and the 'fitness' of the community in a governance system that is in a constant state of flux.

As argued in Chapters Four, Five and Six, the tags, building blocks and internal models of eco-ethical ideology have created a multitude of environmental epistemic communities, not least because complex adaptive systems are characteristically self-organising and the tags that are used repeatedly serve as signposts that attract like-minded agents. The high seas epistemic community is one of many circulating in the international environmental policy arena, its participants motivated by a need to contribute to providing solutions to problems as quickly as possible and on the largest possible scale through macro-goals.

The rise of macro-goals and mega-conferences in contemporary multilateral diplomacy has not been commensurate with the speed of implementation at the domestic level. For instance, the aspirations expressed in Agenda 21 of the 1992 Rio Earth Summit, and its 'daughter' conference, the 2002 World Summit on Sustainable Development (WSSD), are at odds with the international community's capacity to achieve the lofty ambitions that emerge from such large scale gatherings. The atmosphere of excitement and anticipation engendered by spectacular opening ceremonies and stirring key note speeches means participants become caught up in the mood of the moment. Pragmatism is frequently subsumed by the urgency to confirm the commitment of the majority and have as many signatures as possible on the resulting multilateral document to be announced at the conference's completion.

Large scale gatherings seem to encourage broad scale objectives and the credo that 'bigger is better' until the problems of implementation, coordination and funding arise. Environmental NGOs, acting in the belief that they are the international community's moral compass and nature's key ally, work feverishly in the lead up to, and throughout the proceedings of these mega-conferences to encourage governments to embrace eco-ethical, large scale solutions to natural resource management problems. A "mismatch of scale" (Agardy 2005, 243) between global NGO conservation priorities and those of nation states soon becomes evident once bureaucrats return to the more mundane business of domestic government.

What has been the impact of high seas MPA discourse on the governance system in which it is played out?

The regularity and repetitiveness of the high seas epistemic community's priority social goal and primary tag has, through a process of osmosis, permeated the more formal global oceans governance fora. The short run horizontal interactions that were examined in Chapters Four and Five demonstrated subsystem behavioural patterns and flows of information which had filtered up via longer run vertical interactions to 'higher' hierarchical levels of the system. These patterns of behaviour have been driven by the repetitiveness of the high seas epistemic community's language and terminology – its tags and building blocks – in the more 'formal' action settings of the global oceans governance cas.

As demonstrated in Chapters Four and Five, and analysed in Chapter Six, the high seas epistemic community has been instrumental in embedding its primary tag of *a global representative system of MPAs by 2012* in international oceans governance discourses and aligning its calls for high seas MPAs with achievement of the primary tag. There are, however, numerous paradoxes in this approach, as discussed at length in Chapter Six. These were teased out by employing the *cas* organising principles or 'basics' as metaphors for analysis, and the two key contradictions identified were:

- The paradox between the high seas epistemic community's championing of the primary tag with its fixed, finite, linear and immutable goals, vis-à-vis the complex, adaptive, non -linear and perpetually novel characteristics of the global oceans governance system within which it sits; and
- The paradox between the high seas epistemic community's call for an implementing agreement to the 1982 LOSC or creation of a new global and legally binding instrument to legitimise high seas MPAs while simultaneously criticising the effectiveness of existing instruments crafted with the intention of protecting oceans biodiversity.

These paradoxes endure in the language of the more formal oceans governance action settings. As described in Chapter Five, however, the concerns and apprehensions of some countries and institutions about high seas MPAs, global representative systems, and proposals for new multilateral instruments have risen exponentially with the growing influence of international environmental NGOs.

By drilling deeper into high seas MPA discourse, can alternative and more effective means of achieving their creation be identified?

Chapter Three described all complex adaptive systems as emergent systems where patterns of behaviour, identifiable properties, basic rules and coherent structures emerge from the interactions between agents at various hierarchical levels within the *cas*, and where the *cas* itself exhibits patterns of 'whole' behaviour that can be discerned over long periods. While control is highly dispersed in *cas*, complex adaptive systems do have leverage points whereby small amounts of input have the capacity to produce significant changes. Agents that have achieved a level of 'fitness' keep the *cas* functional by creating and taking advantage of conditions that are both necessary and sufficient for the system's survival. Chapter Seven identified and explored a leverage point for protection of deep oceans biological diversity – a prototype high seas MPA. While a comparatively small input, it has potential to produce significant changes in high seas biodiversity management, or at minimum, steer the approach toward marine protected areas in oceans beyond national jurisdiction in a more practical direction.

Diversity serves a distinct purpose in evolution and progression - as each adaptation takes place it generates potential for new interactions and creation of new niches. As Chapter Three pointed out, this phenomenon contributes to a *cas* characteristic termed *perpetual novelty* (Holland 1995, 27). Similarly, prototypes adapted to new circumstances may lead to diversification through the stimulation of new waves of innovation within the system. A high seas MPA prototype would introduce a perpetually novel element into the global oceans governance *cas*. As long as the problem or issue remains a priority (for example, if the protection of deep oceans biodiversity remains on the issue attention agenda of the global oceans governance *cas*), de facto standards can be crystallised through examples of protective mechanisms such as a 'successful' high seas MPA prototype. Success with the prototype will realise further commitment for additional resources to adapt and diffuse effective models (Lasswell 1963, 107-7; Brunner and Clark 1997, 55). The successful prototype will provide the global oceans governance *cas* with *empirical* evidence of organic or structural change. De facto standards guide attention toward what has been achieved by innovative leaders (opinion leaders and/or change agents), and perhaps what can be achieved by other actors in the *cas* (Brunner and Clark 1997, 55).

Chapter Seven explored the creation of a prototype high seas MPA built on informal agreement among the small number of countries *directly* involved in the deep ocean activity that is attracting attention. A successful prototype would represent the first *real* test of political will and commitment of countries involved in the activity to protect vulnerable geomorphic features in waters beyond national jurisdiction.

Directions for Further Research

I have argued in this thesis that a prototyping approach be pursued to test the high seas MPA concept. The prototype would assess the political will of the small number of countries involved in an activity or activities that may, or are, impacting negatively on deep ocean geomorphic features.

Further research could advance the concept of a prototype hydrothermal vent high seas MPA by identifying the relevant parties or institutions, developing a project strategy, management plan, and exploring the most efficient means of bringing them to the negotiating table as well as how agreement might be reached. The focus of research would be on assessing the level of political will and capacity and the degree of interest in the issue of high seas MPAs. The key question, however, remains: Is the high seas MPA concept, irrespective of how the discourse has been captured by its epistemic community, still 'an idea whose time has come, or has a more compelling issue come to the fore? As Kingdon (2003, 1) notes:

> The phrase, 'an idea whose time has come', captures a fundamental reality about an irresistible movement that sweeps over our politics and our society, pushing aside everything that might stand in its path. We feel that such an event can be recognized by signs like sustained and marked changes in public opinion,

> repeated mobilization of people with intensely held preferences, and bandwagons onto which politicians of all persuasions climb.

The sweep of the concept of high seas MPAs in international politics and oceans governance in the last few years appears to have subsided while other challenging issues crowded its path. While a core group of actors with intensely held preferences remain mobilised, other bandwagons have rolled into the international relations corral and the attention of agents has been diverted to new moral dilemmas, in particular, ways of adapting to, and mitigating the impacts of global climate change, which, while not mutually exclusive, commands the development of a new suite of ambitious macro-goals driven by a blend of eco-ethical ideologies and economic rationalism. Nevertheless, a body of research ready to inform the development of a high seas marine protected area prototype, should one be needed, would represent a proactive rather than reactive approach to mitigate the potential impacts of new extractive or research methodologies on sensitive deep ocean ecosystems.

In terms of further research into high seas MPAs, governance and biodiversity protection, I would be more inclined to delve deeper into whether high seas MPAs are needed at all. Appendix 1 of Chapter Four provides an extensive but not exhaustive list of the policy, regulatory and legal components of the global oceans governance system which include protection of oceans biodiversity in their design mandates. Further, subsections of the marine scientific research community have developed Codes of Conduct, as have the marine mining, shipping and cruise industries. In the context of commercial fishing, deep sea fishers rely on cheap and abundant fossil fuels to make their long voyages cost effective. As such, they may be the first to be impacted by prohibitively high oil prices and it has been suggested that some areas of the high seas could become "quasi-marine reserves" as deep sea fishing becomes commercially unviable for large trawlers (Pauly et al 2003). Although incremental, the commercial fishing industry is edging toward self-regulation, as evident in the area closures initiated by numerous regional fisheries management organisations, and this may have the desired effect of protecting the ecological health of certain types of geomorphic features without the need to establish high seas marine protected areas.

Research into the current suite of measures and institutions crafted to protect oceans biodiversity and reduce anthropogenic impacts would require a forensic approach in order to tease out the net effect on high seas biological diversity in its entirety – its resources, its fauna and flora, the water column, the seabed's geomorphic features and the surface. It would be a formidable task, but one which may ultimately demonstrate that in terms of the scope, depth and efficacy of measures to protect oceans biodiversity, the global oceans governance *cas* is indeed much more than the sum of its parts.

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APPENDIX 1.

Extent of the Instrument Components of the Global Oceans Governance Complex Adaptive System (adapted from Kimball, 2001, Ardron 2007 and FAO 2010).

Regional Framework Conventions and Non-Binding Agreements on the Marine Environment
Europe/Northeast Atlantic Ocean – Convention for the Protection of the Marine Environment of the North East Atlantic (1992), referred to as the OSPAR Convention. Includes a small section of the Arctic Ocean. This convention supersedes the 1972 Oslo Convention on dumping and the 1974 Paris Convention on land-based sources. Approximately 40 per cent of the water column in the OSPAR Maritime Area is beyond national jurisdiction, although it is unclear how much of the seafloor is assumed to be beyond national jurisdiction. OSPAR has committed to the establishment of an “ecologically coherent” and “well-managed” network of MPAs by 2010 for the entire OSPAR Maritime Area, including the high seas. In force 1998. – Convention on the Protection of the Marine Environment of the Baltic Sea Area (1992), known as the Helsinki Convention. This convention supersedes the 1974 Baltic Convention. The governing Body is the Helsinki Commission, referred to as HELCOM. In force January 2000. – Charter of the International Council for the Exploration of the Sea (ICES) (1902), revised as the Convention for the ICES (1964) and 1970 Protocol. In force 1968 and 1975 respectively. *West Africa/South Atlantic Ocean* – Convention for the Cooperation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (1981). In force 1984. *Mediterranean/Black/Caspian Seas* – Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (1995). The original convention was modified by amendments adopted in June 1995. In force July 2004. – International Commission for the Scientific Exploration of the Mediterranean (1910). The Commission was created early in the last century to promote international research in the Mediterranean Sea and the Black Sea. CIESM acts as a focus for the exchange of ideas, the communication of scientific information and the development of scientific standards across the Basin[101]. – Convention on the Protection of the Black Sea against Pollution (1992). In force 1994. – The Framework Convention for the Protection of Marine Environment of the Caspian Sea. In force November 2003. *Western Asia/East Africa/Indian Ocean* – Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution (1978). In force 1979. – Regional Convention for the Conservation of the Marine Environment of the Red Sea and the Gulf of Aden Environment (1982). In force 1985 – Convention for the Protection, Management and Development of the Marine and Coastal

[101] http://www.ciesm.org/about/mission/index.htm

Environment of the Eastern African Region (1985). In force 1996.

- South Asian Seas Action Plan (1995). UNEP/South Asian Cooperative Environment Programme (SACEP). Non binding.

East Asia/South Pacific Ocean

- Convention for the Protection and Development of Natural Resources and Environment of the South Pacific Region (1986). In force 1990

- South Pacific Regional Environment Programme (SPREP) – Agreement Establishing the SPREP (1993). In force 1995.

- East Asian Seas Action Plan (1983, revised 1994). UNEP/Coordinating Body on the Seas of East Asia (COBSEA). Non-binding.

East Asia/North Pacific Ocean

- Convention for a North Pacific Marine Science Organization (1990) PICES (Pacific ICES). In force 1992.

- Northwest Pacific Action Plan (1992). Non-binding.

Latin America/Pacific Ocean

- Convention for the Protection of the Marine Environment and Coastal Areas of the South East Pacific (1981). CPPS (Permanent Commission for the South Pacific). In force 1986.

- Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPF Convention). In force June 2004.

Caribbean Sea

- Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (1983). In force 1986.

Antarctic/Southern Ocean

- Antarctic Treaty (1959). In force 1961.
- Protocol on Environmental Protection (Madrid Protocol (1991). In force 1998.

Arctic Ocean

- Arctic Environmental Protection Strategy (1991). Arctic Council. Non-binding.
- Declaration on the Establishment of the Arctic Council (1996). Non-binding.

Vessels

As the following arrangements and related codes are updated frequently through the International Maritime Organization, amendments are not indicated here.

Global Agreements

Vessel Safety and Pollution Control

- UN Convention on the Law of the Sea (1982). In force 1994.

- International Convention on Load Lines (1966), in force 1968. 1995 amendments in force January 2005.

- International Convention on Tonnage Measurements of Ships (1969). In force 1982.

- Convention on the International Regulations for Preventing Collisions at Sea (1972). In force

1977.

- International Convention for the Prevention of Pollution from Ships (1973) and 1978 Protocol (MARPOL 73/78). In force 1983.
  - Annex I – Oil Discharges
  - Annex II – Noxious Liquid Substance Discharges
  - Annex III – Harmful Substances in Packaged Form and Containers
  - Annex IV – Sewage Discharges
  - Annex V – Garbage Discharges
  - Annex VI – Regulations for the Prevention of Air Pollution from Ships (Protocol of 1997)
  - International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) is mandatory under MARPOL 73/78 (and SOLAS)
  - International Maritime Dangerous Goods Code (IMDG Code) is mandatory under MARPOL 73/78 (and SOLAS) as of 1 January 2002
  - Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code) is mandatory under MARPOL 73/78

- International Convention for the Safety of Life at Sea (SOLAS 1974), in force 1980, and 1978 in force 1981 and 1988 Protocols not in force.
  - International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) is mandatory under SOLAS
  - IBC Code is mandatory under SOLAS (and MARPOL 73/78).
  - International Code for Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (INF Code) is mandatory under SOLAS as of 1 January 2001
  - IMDG Code is mandatory under SOLAS (and MARPOL 73/78, Annex III) as of 1 January 2002
  - International Safety Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code) is mandatory under SOLAS for certain ships as of July 1998 and for all ships as of 1 July 2002

- International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW 1978, as substantially revised in 1995). In force 1984 and 1997 respectively.
  - Seafarers' Training, Certification and Watchkeeping Code, Part A is binding under STCW as of February 1997

- Convention on the Physical Protection of Nuclear Material (1979). In force 1987.

- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Wastes Management (1997). In force June 2001.

- UN Convention on Conditions for Registration of Ships (1986). Not in force

- Technical Code on Control of Emissions of Nitrogen Oxides from Marine Diesel Engines (1998)

Global Agreements

Labour Standards

- Merchant Shipping (Minimum Standards) Convention (1976), in force 1991, and 1996 Protocol in force January 2003.[102]

- Convention Concerning Seafarers Welfare at Sea and in Port (1987). In force 1990.
- STCW Convention as above.

[102] http://www.ilo.org/ilolex/cgi-lex/convde.pl?C147

Fishing Vessels

- The Torremolinos International Convention for the Safety of Fishing Vessels, 1977. The Convention has been superseded by the 1993 Protocol. Not in force.

- International Convention on STCW for Fishing Vessel Personnel (STCW-F 1995). In force February 1997.

- Code of Safety for Fisherman and Fishing Vessels and Voluntary Guidelines.

Emergency Preparedness and Response

- International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (1969), in force 1975, and 1973 Protocol, in force 1983.

- International Convention on Salvage (1989). In force 1996.

- International Convention on Oil Pollution Preparedness, Response and Cooperation (1990). In force 1995.
  - Protocol regarding hazardous and noxious substances (2000)

- Draft Wreck Removal Convention. Not yet in force.

Liability and Compensation

- International Convention on Civil Liability for Oil Pollution Damage (1969), in force 1975, and 1976 and 1992 Protocols, in force 1981 and 1996 respectively.

- International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (1971), in force 1978, and 1976 and 1992 Protocols, in force 1994 and 1996 respectively.

- Convention on the Liability of Operators of Nuclear Ships (1962). Not in force

- Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material (1971). In force 1975.

- Convention on Limitation of Liability for Maritime Claims (1976), in force 1986, and 1996 Protocol, in force May 2004.

- International Convention on Liability and Compensation in Connection with the Carriage of Hazardous and Noxious Substances by Sea (1996). Not in force

- International Convention on Civil Liability for Bunker Oil Pollution Damage (2001). In force November 2008.[103]

Vessel Routeing and Protected Areas

- MARPOL 73/78 Special Areas: Annex I (no oily discharges) – the Mediterranean Sea and the Antarctic area south of 60ºS; Annex II (no noxious liquid discharges) – Antarctic area south of 60ºS; and Annex V (no garbage discharges) – Antarctic area south of 60ºS.

- UN Law of the Sea Convention Article 211.6.

- COLREG 1972: These define the competence of the International Maritime Organization to adopt traffic regulation schemes and regulate ships using them.

[103] http://www.imo.org/Conventions/contents.asp?topic_id=256&doc_id=666

- SOLAS 1974
  - Guidelines and Criteria for Ships Reporting (1994/95) are mandatory as of 1 January 1996
  - General Provisions on Ships Routeing (1985) are mandatory as of 1 January 1997
  - Guidelines for Vessel Traffic Services (1985) are mandatory as of 1 July 1999

- Guidelines for the Designation of Special Areas and the Identification of Particularly Sensitive Sea Areas (PSSAs) (1991).[104]

Non-Indigenous Species Introduction

- International Convention for the Control and Management of Ships' Ballast Water and Sediments (2004). Not yet in force.

- International Convention on the Control of Harmful Anti-fouling Systems on Ships (2001). In force September 2008.[105]

- International Guidelines for the Control and Management of Ships' Ballast Water to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens (1997). (A.868(20)) These replace the 1993 Guidelines for Preventing the Introduction of Unwanted Aquatic Organisms and Pathogens from Ships Ballast Water and Sediment Discharges

- Global [Shipping] Industry Alliance to combat marine bio-invasions (2009)

Regional Agreements

Vessel-Source Pollution

- HELCOM Recommendation 22E/5. Adopted 10 September 2001 having regard to Article 20 (1), c) of the Helsinki Convention. Amendments to Annex IV “Prevention of Pollution from Ships” to the Helsinki Convention. In force 2003.[106]

- Annex IV to the 1991 Antarctic Protocol: prevention of marine pollution (1991). In force 1998.

- Code of Conduct for the Prevention of Pollution from Small Ships in Marinas and Anchorages in the Caribbean Region (1996). Non-binding.

Inspection/Enforcement

- Memorandum of Understanding[107] (MOU) on Port State Control (1982) – Europe

- Vina del Mar Agreement on Port State Control (1992) – Latin America

- MOU on Port State Control in the Asia Pacific Region (1993)

- MOU on Port State Control in the Caribbean Region (1996)

- MOU on Port State Control in the Mediterranean Region (1997)

- MOU on Port State Control in the Indian Ocean Region (1998)
- MOU on Port State Control in the West and Central African Region (1999)

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[104] New procedures for adopting PSSAs were approved by the International Maritime Organisation (IMO) in 1999 (A.885(21)), amending the 1991 Guidelines (A.720(17)) (Kimball 2001, 95).
[105] http://www.imo.org/conventions/mainframe.asp?topic_id=529
[106] http://ples.law.ntu.edu.tw/UserFiles/Marpol%20(Eng).pdf
[107] Memoranda of Understanding are informal cooperative arrangements

- MOU on Port State Control in the Black Sea Region (2000). Effective 1 Jan 2010.[108]

- Draft MOU on Port State Control in ROPME Sea Area (Gulf/Kuwait)

Emergency Preparedness and Response

- Agreement Concerning Cooperation in Measures to Deal with Pollution of the Sea by Oil (1971). Nordic Countries. In force 1971.

- Agreement Between the Government of the United States and the Government of Canada Relating to the Establishment of Joint [Marine] Pollution Contingency Plans for Spills of Oil and Other Noxious Substances (1974) and 1977 and 1982 Amendments. In force 1974, 1977, and 1982 respectively.

- North Sea Agreement: for cooperation in dealing with pollution by oil and other harmful substances (1983). This agreement supersedes the 1969 North Sea Agreement. In force 1989 and 1969 respectively.

- Cooperation Agreement for the Protection of the coasts and waters of the North-East Atlantic against Pollution (1990).[109]

- Baltic Sea, Annex VII: response to pollution incidents (1992). In force January 2000.

- West and Central Africa Protocol: concerning cooperation in combating pollution in cases of emergency (1981). In force 1984.

- Mediterranean Sea Protocol: concerning cooperation in combating pollution by oil and other harmful substances in cases of emergency (1976). In force 1978.

- Black Sea Protocol: on cooperation in combating pollution by oil and other harmful substances in cases of emergency (1992). In force 1994.

- Gulf/Kuwait Protocol: concerning regional cooperation in combating pollution by oil and other harmful substances in cases of emergency (1978). In force 1979.

- Red Sea Protocol: concerning regional cooperation in combating pollution by oil and other harmful substances in cases of emergency (1982). In force 1985.

- East African Protocol: concerning cooperation in combating marine pollution in cases of emergency (1985). In force 1996.

- South Pacific Protocol: concerning cooperation in combating pollution emergencies (1986). In force 1990.

- South East Pacific Agreement: on regional cooperation in combating pollution by hydrocarbons and other harmful substances in cases of emergency (1981) and 1983 supplementary protocol. In force 1986 and 1987 respectively.

- Caribbean Protocol: concerning cooperation in combating oil spills (1983). In force 1986.

- Antarctic Protocol and its Annex IV: prevention of marine pollution (1991). In force 1998.

[108] http://www.bsmou.org/PDF/BSMOUT.pdf
[109] http://www.ecolex.org/ecolex/ledge/view/RecordDetails?id=TRE-001097&index=treaties

At-Sea Waste Disposal (Dumping) and Maritime Transport of Wastes
Global Agreements *Dumping* – UN Convention on the Law of the Sea (1982). In force 1994. – Convention for the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention 1972), in force 1975, and 1996 Protocol, in force March 2006.[110] – Dredged Material Assessment Framework (1995). Non binding – Guidelines for the Assessment of Wastes and Other Matter That May Be Considered for Dumping (1997). Non binding. – Guidelines for each of the specific wastes permitted to be dumped under the 1996 Protocol to the London Convention (2000). *Maritime Transport of Wastes and International Trade (see also Table 2:3 on Nuclear Contamination)* – Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention 1989). In force 1992. – The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals in International Trade (1998). In force February 2004.[111] – Stockholm Convention on Persistent Organic Pollutants (2001). In force 2004.[112] – Cairo Guidelines and Principles for the Environmentally Sound Management of Hazardous Wastes (1987). – London Guidelines for the Exchange of Information on Chemicals in International Trade (1987) and 1989 Amendments. – International Code of Conduct on the Distribution and Use of Pesticides (1985) and 1989 Amendments. *Liability and Compensation for Damage (see also Table 2:1)* – Protocol to the Basel Convention on Liability and Compensation for Damage Resulting from Transboundary Movements of Hazardous Wastes and their Disposal (1999). Not in force **Regional Agreements** *Dumping* – North East Atlantic Convention, Annex II: prevention and elimination of pollution by dumping or incineration (1992), in force 1998. This supersedes the 1972 Oslo Convention, in force 1984.. – Baltic Sea Convention, Annex V: exemptions from the general prohibition of dumping of waste and other matter (1992). – Mediterranean Sea Protocol: dumping from ships and aircraft or incineration at sea (1976, in force 1978, as amended in 1995. Not in force.[113]

110 http://www.imo.org/home.asp?topic_id=1488
111 http://www.pic.int/home.php?type=t&id=5&sid=16
112 http://chm.pops.int/Convention/tabid/54/language/en-US/Default.aspx#convtext

– Black Sea Protocol: dumping (1992). In force 1994.

– South Pacific Protocol: dumping (1986). In force 1990.

– South East Pacific Protocol against Radioactive Pollution (1989). In force 1995.

– Antarctic Protocol, Annex III: Waste Disposal and Waste Management (1991). In force 1998.

Regional Agreements
Maritime Transport of Wastes and International Trade

– Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Waste Within Africa (1991). In force 1996.

– Mediterranean Sea Protocol on transboundary movements of wastes and their disposal (1996). Not in force.[114]

– Gulf/Kuwait Protocol on the control of marine transboundary movements and disposal of hazardous and other wastes (1998).

– The Waigani Convention to Ban the Importation into Forum Island Countries of Harzardous and Radio Active Waste and to Control the Transboundary Movement of Harzardous Waste within the South Pacific Region (1995). In force 2001.[115]

– Ban on the export of hazardous wastes for disposal in Antarctica under the Basel Convention (1989). In force 1992.

– LRTAP Protocol on POPs (1998). In force 2003.[116]

Nuclear Contamination from the Marine Perspective

NUCLEAR SAFETY AND RESPONSIBILITY IN GENERAL
Global Agreements

– Convention on Physical Protection of Nuclear Material (1979). In force 1987.

– Convention on Nuclear Safety (1994). In force 1996.

– Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Wastes Management (1997). In force June 2001.[117]

Emergency Preparedness and Response

– Convention on Early Notification of a Nuclear Accident (1986). In force 1986.

[113]http://www.cyprus.gov.cy/moa/agriculture.nsf/All/C597C8AC06A1BD85C22573FB00619B11/$file/Protocol%20for%20the%20Prevention%20and%20Elimination%20of%20Pollution%20of%20the%20Mediterranean%20Sea%20by%20Dumping%20from%20Ships%20and%20Aircraft%20or%20Incineration%20at%20Sea.pdf?OpenElement
[114]http://www.moa.gov.cy/moa/Agriculture.nsf/All/8B39BEF9BBEF90ADC22573FB0061B133/$file/Protocol%20on%20the%20Prevention%20of%20Pollution%20of%20the%20Mediterranean%20Sea%20by%20Transboundary%20Movements%20of%20Hazardous%20Wastes%20and%20their%20Disposal.pdf?OpenElement
[115] http://www.unescap.org/DRPAD/VC/orientation/legal/3_waste.htm
[116] http://www2.eiatrack.org/r/309&Is_News=0&kw=endrin
[117] http://www.iaea.org/Publications/Documents/Conventions/jointconv.html

– Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1986). In force 1987.

Liability and Compensation

– Vienna Convention on Civil Liability for Nuclear Damage (1963) and 1963 and 1997 Protocols.
  - Joint Protocol Relating to the Application of the Vienna and Paris (below) Conventions (1988).

– Convention on Supplementary Compensation for Nuclear Damage (1997). Not in force.

Regional Agreements

– Paris Convention on Third Party Liability in the Field of Nuclear Energy (1960), in force 1968, and 1964, in force 1974, and 1982 Protocols, in force 1988, and Supplementary Convention (1963) and 1964 and 1982 Protocols.
  - Joint Protocol Relating to the Application of the Vienna and Paris (below) Conventions (1988). In force 1992.

INTERNATIONAL TRADE/MARITIME TRANSPORT OF NUCLEAR MATERIALS AND RADIOACTIVE WASTE

Global Agreements

– UN Law of the Sea Convention, Articles 22.2 and 23.[118] In force 1994.

– International Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (1993), mandatory under SOLAS as of 1 January 2001 (INF Code).

Emergency Preparedness and Response

– Table 2:1 insofar as radioactive substances may be covered.

Liability and Compensation

– Convention on the Liability of Operators of Nuclear Ships (1962). Not in force.

– Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material (1971). In force 1975.

Regional Agreements

– Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes Within Africa (1991).[119] Not in force.

– The Waigani Convention to Ban the Importation into Forum Island Countries of Harzardous and Radio Active Waste and to Control the Transboundary Movement of Harzardous Waste within the South Pacific Region (1995). In force 2001.

– Northeast Atlantic Strategy with regard to Radioactive Substances (1998). Non binding.

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[118] Provides that in exercising innocent passage in the territorial sea, foreign ships carrying nuclear or other inherently dangerous or noxious substances and nuclear-powered ships must carry documents and observe special precautionary measures established for such ships by international agreements and may be required to travel in designated sealanes (Kimball 2001, 99).

[119] Although the Basel Convention does not cover radioactive wastes addressed under other international control systems such as the London Convention, the Bamako Convention for Africa bans all at-sea dumping and seabed disposal. This supplements protections for countries that are not party to the London Convention (Kimball 2001, 99).

DISPOSAL OF RADIOACTIVE WASTE (SEE ALSO TABLE 2:2)
Global Agreements
- Ban on At-Sea Disposal. London Convention (1972), in force 1975, and 1996 Amendments, in force 2006.[120]

Regional Agreements
- Ban on At-Sea Disposal under the regional dumping instruments[121] (Table 2:2).

- Ban on Disposal in Antarctica. Antarctic Treaty (1959). In force 1961.

NUCLEAR FREE ZONES
Global Agreement s
- Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water (1963). In force 1963.

- Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction in the Seabed and the Ocean Floor and the Subsoil thereof (1971). In force 1972.

- Comprehensive Nuclear Test Ban Treaty (1996). Not in force.

Regional Agreements
- Treaty for the Prohibition of Nuclear Weapons in Latin America (1967), in force 1968, and Protocols, in force 1969.
- South Pacific Nuclear Free Zone Treaty (1985), in force 1986, and 1986 Protocols, in force 1988.

- African Nuclear Weapon Free Zone Treaty and Protocols (1995)[122]. Not in force.

- Treaty on the Southeast Asia Nuclear Weapon Free Zone and Protocols (1995)[123]. In force 1997.

- Antarctica: Ban on nuclear explosions, weapons testing and the disposal of radioactive wastes. Antarctic Treaty (1959). In force 1961.

Pollution from Land-Based Sources and Activities

Global Agreements
- UN Convention on the Law of the Sea (1982). In force 1994.

Explicit Linkages
- UN Convention on the Law of the Non-navigational Uses of International Watercourses (1997). Not in force.

[120] http://www.imo.org/Conventions/contents.asp?topic_id=258&doc_id=681
[121] For example, the Baltic Sea Convention bans all dumping of radioactive wastes; the Northeast Atlantic Convention does the same, with exemptions for two Parties; and the 1986 South Pacific Regional Seas Convention prohibits storage of radioactive wastes or other radioactive matter and calls for measures to prevent, reduce, and control pollution from the storage of toxic and hazardous wastes and the testing of nuclear devices (Kimball 2001, FN 3 p99).
[122] The African treaty covers dumping of radioactive wastes or other radioactive material only within the territorial sea and archipelagic waters (Kimball 2001, 99).
[123] The Southeast Asia Treaty covers dumping in the territorial sea, archipelagic waters, EEZ, and continental shelf and defines dumping to include the deliberate disposal at sea of vessels, aircraft or other structures containing radioactive material (Kimball 2001, 99).

- Stockholm Convention on Persistent Organic Pollutants (2001). In force 2004.

- Global Programme of Action on Protection of the Marine Environment from Land-Based Activities (1995). This agreement effectively supersedes the Montreal Guidelines for the Protection of the Marine Environment against Pollution from Land-based Sources (1985). Non binding.

- International Code of Conduct on the Distribution and Use of Pesticides (1985) as amended.

- Cairo Guidelines and Principles for the Environmentally-Sound Management of Hazardous Wastes (1987).

Emergency Preparedness and Response

- Convention Concerning Safety in the Use of Chemicals at Work (1990). In force 1993.

- Convention Concerning the Prevention of Major Industrial Accidents (1993). In force 1997.

Regional Agreements

- Northeast Atlantic, Annex 1: on the prevention and elimination of pollution from land-based sources (1992), in force 1998. This supersedes the 1974 Paris Convention, in force 1978.

- Baltic Sea, Annex III: criteria and measures concerning the prevention of pollution from land-based sources (1992).

- Mediterranean Sea, Protocol: (1980), in force 1983, as amended in 1996, Not in force.

- Black Sea, Protocol: pollution from land-based sources (1992). In force 1994.

- Gulf/Kuwait, Protocol: pollution from land-based sources (1990). In force 1993.

- South East Pacific, Protocol: pollution from land-based sources (1983). In force 1986.

- Wider Caribbean, Protocol: pollution from land-based sources and activities (1999). Not in force.

Explicit Linkages

- Environmental Impact Assessment (EIA):
  - Convention on EIA in a Transboundary Context (1991). In force1997.
  - European Community Directives
  - Nordic Convention (1974). In force 1976.
  - Antarctic Protocol, Annex I (1991). In force 1998.

- Emergency Preparedness and Response:
  - Convention on Transboundary Effects of Industrial Accidents (1992).
- Liability and Compensation:
  - Nordic Convention (1974). In force 1976.

  - Convention on Civil Liability for damages resulting from activities dangerous to the environment (1993). In force April 2004.[124]

[124] http://www.cambridge.org/uk/catalogue/catalogue.asp?isbn=9780521889971&ss=exc

POLLUTION FROM OFFSHORE ACTIVITIES

Global: General

- UN Convention on the Law of the Sea (1982). In force 1994.

- MARPOL 73/78 covers fixed and floating platforms.

- The London Convention covers fixed and floating platforms, including at-sea disposal of offshore structures.

Both IMO Conventions exempt discharges and dumping from facilities related to seabed minerals development and processing except for certain oil discharges.

- Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the EEZ (1989).
    - Recommendations on Safety Zones and Safety of Navigation around Offshore Installations and Structures (1989)
    - Code for the Construction and Equipment of Mobile Offshore Drilling Units (1989)

- Code for the Safe Practice for the Carriage of Cargoes and Persons by Offshore Supply Vessels (1997).

- Recommendations on Training of Personnel on Mobile Offshore Units (1999)

Global Oil and Gas Activities

Emergency Preparedness and Response

- International Convention on Oil Pollution Preparedness, Response and Cooperation (1990). In force 1995.

- Guidelines and Principles on Offshore Mining and Drilling (1982).

Regional Oil and Gas and Other Offshore Minerals Activities[125]

- Northeast Atlantic, Annex III: offshore sources (1992). In force 1998.

- Baltic Sea, Annex VI: offshore activities (1992).

- Mediterranean Sea, Protocol: exploration and exploitation of the continental shelf and the seabed and its subsoil (1994).

- Gulf/Kuwait, Protocol: exploration and exploitation of the continental shelf (1989). In force 1990.

Environmental Impact Assessment (EIA)

- Convention on EIA in a Transboundary Context (1991). In force 1997.

- Nordic Convention (1974). In force 1976.

Emergency Preparedness and Response

- See Table 2:1

Liability and Compensation

- Nordic Convention (1974). In force 1976.

[125] The Northeast Atlantic, Baltic Sea and Gulf/Kuwait agreements cover offshore oil and gas exclusively, while the Mediterranean Sea Protocol covers all activities pertaining to mineral resources (Kimball 2001, Footnote 1, p101).

- Convention on Civil Liability for Oil Pollution Damage resulting from Exploration and Exploitation of Seabed Mineral Resources (1977). This Convention covers the North Sea, Baltic Sea, and Northeast Atlantic. Status unknown.

Other Regional Activities

The following regional protocols on land-based sources of marine pollution cover discharges from offshore facilities and structures used for purposes other than exploration and exploitation of the seabed/continental shelf (Kimball 2001, 101).

- Gulf/Kuwait
- Mediterranean Sea.

Pollution From or Through the Air

Global Agreements

- UN Convention on the Law of the Sea (1982).

Aircraft

- Convention on International Civil Aviation (1944). In force 1947.

Ships

- MARPOL 73/78, Annex VI, Regulations for the Prevention of Air Pollution from Ships (1997). In force May 2005.[126]

- Technical Code on Control of Emissions of Nitrogen Oxides from Marine Diesel Engines (1998).

Offshore Installations and Structures

- MARPOL 73/78, Annex VI applies to fixed and floating platforms and drilling rigs but exempts emissions from offshore activities related to seabed minerals development.

Greenhouse Gases and Ozone Depletion

- Framework Convention on Climate Change (1992).
  - Kyoto Protocol (1997). In force February 2005.

- Vienna Convention for the Protection of the Ozone Layer (1985). In force 1988.
  - Montreal Protocol on Substances that Deplete the Ozone Layer (1987). In force 1989.

Regional Agreements

Land-based Sources

All seven regional instruments on land-based marine pollution explicitly cover airborne deposition to the marine environment. In addition, the framework regional agreements (Table 1:1) cover airborne sources of marine pollution and the Red Sea/Gulf Aden Convention refers explicitly to airborne sources in its article on land-based sources.

- Convention on Long-Range Transboundary Air Pollution (1979). In force 1983.
  - Protocol on Long-Term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (1984). In force 1988.

  - Protocol Concerning the Reduction of Sulphur Emissions or Their Transboundary Fluxes (1985). In force 1987.
  - Protocol Concerning the Control of Emissions of Nitrogen Oxides or Their Transboundary Fluxes (1985). In force 1991.
  - Protocol Concerning the Control of Emissions of Volatile Organic Compounds (VOCs) or Their Transboundary Fluxes (1991). In force 1997.
  - Protocol on Further Reductions of Sulphur Emissions (1994). In force 1998.
  - Protocol on POPs (1998). In force October 2003.[127]

[126] http://www.imo.org/Conventions/contents.asp?doc_id=678&topic_id=258#11

- Protocol on Heavy Metals (1998). In force December 2003.[128]
- Draft Protocol on integrated acidification, ground level ozone, eutrophication.

Offshore Installations and Structures
The four regional instruments on offshore facilities and structures (Table 2:5) cover airborne deposition to the marine environment, although the Baltic Sea agreement is less explicit than the others (Kimball 2001, 102).

Ships
The Baltic Sea is a sulphur oxide emission control area under MARPOL 73/78 Annex VI.

Sustainable Fisheries

Global Agreements
Fishing

- UN Convention on Law of the Sea (1982):
  - Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks (FSA) (1995). In force December 2001.[129]

- Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (1993). In force April 2003.

- Convention on Biological Diversity (CBD) (1992). In force 1993.

- Code of Conduct for Responsible Fisheries (1995)

- UN General Assembly Resolutions on Large-Scale Pelagic Driftnet Fishing and Its Impacts on the Living Marine Resources of the World's Oceans and Seas (1989, 1990, 1991).

- FAO Global Plans of Action (non-binding):
  - to reduce the incidental catch of seabirds in long-line fisheries (1999)
  - for the conservation and management of sharks (IPOA-Sharks) (1999)
  - for the management of fishing capacity (1999).
  - to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (2001).

Technical and legal guidance on fisheries, mariculture and marine species is addressed below.

Fishing vessels (See also Table 2:1)

- 1993 Compliance Agreement (above). Not in force?

- Standard Specifications for Marking and Identification of Fishing Vessels (1989). Non binding.

Marine Mammals (see Table 2:8)

Marine Debris

- Annex V (Garbage) MARPOL 73/78.
- London Convention (1972).

Mariculture

- Convention on Biological Diversity (1992). In force 1993.

[127] http://www.ecolex.org/ecolex/ledge/view/RecordDetails;jsessionid=CB95C5FFFF2B4961E54DB2A92 91166CE?id=TRE-001281&index=treaties
[128] http://euro.who.int/eehc/ctryinfo/conven/specific/20060302_27
[129] http://www.fao.org/docrep/009/a0653e/a0653e03.htm

- Cartagena Protocol on Biosafety (2000). In force September 2003.

- Code of Practice on the Introduction and Transfers of Marine Organisms (1994) (ICES). This supersedes earlier versions of 1973, 1979, and 1990. Non-binding

- Code of Conduct for Responsible Fisheries (1995) (FAO). Non-binding

Non-Indigenous Species and Genetically Modified Organisms (See Table 2:8)

Regional Agreements and Regional Fisheries Organisations

North Atlantic Ocean

- Convention on Fishing and Conservation of the Living Resources in the Baltic Sea and Belts (1973). International Baltic Sea Fishery Commission (IBSFC). In force 1974.

- Convention on Future Multilateral Cooperation in North East Atlantic Fisheries (1980). North East Atlantic Fisheries Commission NEAFC). In force 1982. NEAFC spatial conservation measures include closure of five areas to bottom fishing from January 2005 until December 2007 (Hecate, Altair, Antialtair and Faraday seamounts, and a large section of the Reykjanes Ridge); and from 2007 to end of 2009, closure of Hatton Bank and three areas of Rockall Bank to bottom fishing. NEAFC has also banned gillnet fishing in depths greater than 200m.

- Convention for the Conservation of Salmon in the North Atlantic Ocean (1982). North Atlantic Salmon Conservation Organization (NASCO). In force 1983.

- Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries (1978). North Atlantic Fisheries Organization (NAFO). In force 1979. NAFO has closed four seamount areas to bottom fishing for a period of three years from 2007, (however from Jan 2008, 20% of the fishable area of each seamount may be opened to a small scale and restricted exploratory fishery. The fishery will be subject to closure if hard corals are encountered, and all measures will be reviewed in 2010, with the option of extension of closures, or possibly made permanent (Ardron 2007).

- European Community Treaty (1957). In force 1958.

- Agreement to end unregulated fisheries of regulated stocks in the high seas area of the Barents Sea ("Loophole Agreement" 1999). In force 1999.

Central/South Atlantic Ocean

- International Convention for the Conservation of Atlantic Tunas (ICCAT) (1966), in force 1969.

- Regional Convention on Fisheries Cooperation among African States Bordering the Atlantic Ocean (1991). In force 1995.

- South East Atlantic Fisheries Organization (SEAFO). All fishing activities for species covered by the SEAFO Convention are prohibited from 1 January 2007 to 31 December 2010 in ten high seas fishing areas. SEAFO annual meetings can consider restricted re-openings of closed areas not exceeding 20% of the fishable area (Ardron 2007).

Mediterranean/Black/Caspian Seas

- Convention Concerning Fishing in the Black Sea (1959). In force 1960.
- Draft Agreement on the conservation and rational use of biological resources in the Caspian Sea (1992)[130].

[130] This agreement has not been signed pending resolution of the legal status of the Caspian Sea. See UN Doc. A/54/461, 15 October 1999, paragraph 9.

Indian Ocean

- Western Indian Ocean Tuna Organisation Convention (1991). In force 1994.

- Southern Indian Ocean Deepwater Fishers' Association (SIODFA) (2006). Voluntary closures in 11 high seas areas. SIODFA represents four deepwater fisheries companies with a total of four vessels (Ardron 2007).

- Bay of Bengal Programme Intergovernmental Organisation (BOPB-IGO) (1999). In force 2003.

North Pacific Ocean/Bering Sea

- Pacific Salmon Treaty (1985). US/Canada. In force 1985.

- Convention Between the United States and Canada for the Preservation of the Halibut Fishery of the Northern Pacific Ocean and Bering Sea (1953), in force 1953, and 1979 Protocol, in force 1980.

- Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean (1992). North Pacific Anadromous Fisheries Commission (NPAFC). In force 1993.

- Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea (1994) (CCBSP). In force 1995.

Central/Eastern Pacific Ocean

- Convention for the Establishment of an Inter-American Tropical Tuna Commission ((1949) (IATTC)[131]. In force 1950
  - *Selective Gear*: Agreement to Reduce Dolphin Mortality in the Eastern Tropical Pacific Tuna Fishery (1992). In force 1992.

- Agreement for the International Dolphin Conservation Programme (1998). In force 1999.

- Latin American Organization for Fisheries Development (OLDEPESCA) (1982). In force 1984.

- Forum Fisheries Agency (FFA) (1979). In force 1979.

Western/Central Pacific

- Western and Central Pacific Fisheries Commission (WCPFC) (1994. In force 2004.

Asia Pacific Region

- Asia Pacific Fisheries Commission (1948). In force 1948 with amendments in 1958, 1961, 1977, 1994 and 1996.[132]

South Pacific Ocean

- South Pacific forum Fisheries Agency Convention (1979). Forum Fisheries Agency (South Pacific Forum) (FFA). In force 1979.

- Treaty on Fisheries between the Governments of Certain Pacific Island States and the Government of the United States of America (1987). In force 1988. This will be superseded by the following draft convention:

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[131] The IATTC replaced the 1983 Eastern Pacific Ocean Tuna Fishing Agreement and Protocol and the 1989 Convention for the conservation, protection and optimal utilization of tuna fish in the Eastern Pacific Ocean, which never entered into force (Kimball, FN 2 p105).

[132] FAO Fisheries and Aquaculture Department (2010), "Asia Pacific Fisheries Commission". Available online: http://www.fao.org/fishery/rfb/apfic/en Date of access 7 April 2010.

- Agreed Minutes on Surveillance and Enforcement Cooperation

- Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (2000). In force June 2004.[133]

- Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest (1982) and two implementing arrangements. In force 1982.
  - Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region (1992). In force 1993.
  - Harmonized Minimum Terms and Conditions of Access (1993). In force 1993.

- Palau Arrangement for the Management of Western Pacific Purse Seine Fishery (1992). In force 1995.

- Federated States of Micronesia Arrangement for Regional Fisheries Access (1994). In force 1995.

- Convention for the Conservation of Southern Bluefin Tuna (1993) (CCSBT). In force 1994.

- South Pacific Regional Fisheries Management Organisation (SPRFMO). Not yet established.

- *Selective Gear*: Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific (1989). In force 1991.

- Nadi Declaration, made during the Pacific Islands Forum which, in addition to EEZs, also addresses any high seas enclaves enclosed by the EEZs of western tropical Pacific island states. In 2006, Ministers from the 16 member states adopted the *Declaration on Deep Sea Bottom Trawling to Protect Biodiversity in the High Seas*. Non-binding.

- Mariculture: Agreement on the Network of Aquaculture Centres in Asia and the Pacific (1988). In force 1990.

Antarctica/Southern Ocean

- Convention on the Conservation of Antarctic Marine Living Resources (1980). (CCAMLR). In force 1982. Measures include prohibition of fishing for all fin-fish species in two CCAMLR statistical sub-areas to the north of the Antarctic Peninsula, several species-specific fishing closures (toothfish, grey rockcod, and lantern fish), interim and temporary bans on bottom trawling and gillnetting, and a ban on all shark fishing from 2006 (Ardron 2007).

Marine Protected Areas and Species

Global Agreements

Protected Species

General

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973). In force 1975.
- Convention on the Conservation of Migratory Species of Wild Animals (CMS) (1979). In force 1983.

- Convention on Biological Diversity (CBD) (1992). In force 1993.

- World Charter for Nature (1982). Non binding.

[133] http://www.wcpfc.int/

Marine Mammals

- UN Convention on the Law of the Sea (1982). In force 1994.
- International Convention on the Regulation of Whaling (1946). International Whaling Commission (IWC). In force 1948.
- SOLAS 1974, mandatory reporting to protect the right whale, see Table 2:1.
- Global Plan of Action for the Conservation, Management and Utilization of Marine Mammals (1984, rev. 1997). Non binding.

Protected Areas

- UNCLOS Articles 194.5 and 162.2.x.
- International Whaling Convention (1946): Antarctic Sanctuary, in force 1938; Indian Ocean, in force 1979; and Southern Ocean Sanctuaries, in force 1994. South Pacific and South Atlantic sanctuaries have also been proposed but to date have failed to garner the 75% majority vote required (Ardron 2007).
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (1971). In force 1975.
- Convention Concerning the Protection of the World Cultural and Natural Heritage (1972). In force 1975.
- Pelagos Sanctuary for Mediterranean Marine Mammals. In force 2001. Accepted by the Barcelona Convention as a Specially Protected Area of Mediterranean Interest (SPAMI). Located in the Ligurian Sea, it spans the internal and territorial waters of France, Italy and the Principality of Monaco, as well as international waters (Ardron 2007).
- Antarctic Treaty: Antarctic Specially Protected Areas (ASPAs). Strictly managed areas, permission must be sought to enter, and permitted activities such as scientific research and monitoring are regulated under management plans. There are six marine ASPAs, and another ten which cover both marine and terrestrial components. The total marine area covered by ASPAs is 1783 km² (Ardron 2007).
- Antarctic Treaty: Antarctic Specially Managed Areas (ASMAs). Designated to assist in the planning and coordination of activities to avoid possible conflicts and reduce environmental impacts. Three of the four existing ASMAs have a marine component are found in areas with high level activity such as scientific research and tourism, which pose environmental risks on a cumulative scale. Activities are guided by a code of conduct, and the total marine area of the three ASMAs is approximately 150 km² (Ardron 2007).
- Agreement Concerning the Shipwrecked Vessel RMS Titanic (the Titanic Agreement). In 2000, the UK, US, Canada and France agreed to protect the remains of RMS Titanic from human disturbance and salvage. The Agreement has been signed and ratified by the UK (2003) which has also enacted enabling legislation, signed but not ratified by the US (2004), and neither signed nor ratified by Canada or France. In 2007, the US Government sought implementing legislation and Senate consent to allow US ratification (Ardron 2007).
- Action Plan for Biosphere Reserves (1984) and Seville Strategy and Statutory Framework for the World Network of Biosphere Reserves (1995). Non binding.

Regional Agreements

Protected Species

The following are daughter agreements to the 1979 Convention on Migratory Species

- Agreement on the Conservation of Seals in the Wadden Sea (1990). In force 1991.

- Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS 1992). In force 1994.

- Agreement on the Conservation of African-Eurasian Migratory Waterbirds (1995). In force 1999.

- Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS 1996). In force 2002.

- Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2001). In force 2004.

Marine Mammals

- Interim Convention on Conservation of North Pacific Fur Seals (1957) and Protocols. In force 1957.

- Annex II: Conservation of Antarctic Fauna and Flora, Antarctic Treaty Protocol on Environmental Protection (1991). In force 1998.

- Convention on the Conservation of Antarctic Seals (1972). In force 1978.

- Agreement on the Conservation of Polar Bears (1973). Arctic. In force 1976.

- Agreement on Cooperation in Research, Conservation and Management of Marine Mammals in the North Atlantic (1992). In force 1992.

- Action Plan for the Conservation of Cetaceans in the Mediterranean Sea (1991).

Sea Turtles

- Inter-American Convention for the Protection and Conservation of Sea Turtles (1996). In force May 2001.[134]

Marine Protected Areas and Species

- Mediterranean Sea, Protocol Concerning Specially Protected Areas, and Biological Diversity (1995) and 1996 Annexes. This supersedes the 1982 Protocol on Specially Protected Areas. In force December 1999.[135]
- Northeast Atlantic Annex V on the Protection and Conservation of the Ecosystems and Biological Diversity of the Maritime Area (1998). In force.

- East Africa, Protocol Concerning Protected Areas and Wild Fauna and Flora (1985). In force 1996.

- South East Pacific, Protocol: conservation and management of protected marine and coastal areas (1989). In force 1994.

- Caribbean Sea, Protocol: specially protected areas and wildlife (1990). In force April 2000.[136]

[134] http://www.nmfs.noaa.gov/pr/species/turtles/iac.htm
[135] http://www.unep.org/regionalseas/Programmes/unpro/mediterranean/instruments/default.asp
[136] http://www.hsus.org/hsi/policy_and_trade/treaties/protocol_concerning_specially_protected_areas_and_wildlife/

– Antarctica, Annex II: Conservation of Antarctic Fauna and Flora, Antarctic Treaty Protocol (1991). In force 1998. Annex V: Area Protection and Management (1991).

– Draft Gulf/Kuwait Protocol on Biological Diversity and Establishment of Special Protected Areas.

Other Regional Protected Areas and Species

– Convention on the Conservation of European Wildlife and Natural Habitats (1979). In force 1982. This effectively supersedes the 1950 International Convention for the Protection of Birds.

– African Convention on the Conservation of Nature and Natural Resources (1968). In force 1969.

– ASEAN Agreement on the Conservation of Nature and Natural Resources (1985). No evidence of status.

– Convention on the Conservation of Nature in the South Pacific (1976). In force 1990.

– Convention on Nature Protection and Wild Life Preservation in the Western Hemisphere (1940). In force 1942.

– Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora (1994). In force 1996.

Regional Fishing Agreements (See Table 2:7)

Most regional fisheries conventions provide for areas closed to fishing either permanently or during the season when the areas are critical spawning grounds or nurseries (Kimball 2001, 107).

Regional Shipping Measures under Global Agreements

Vessel Routeing and Protected Areas (See Table 2:1)

– Particularly Sensitive Sea Areas (PSSAs) have been designated through the IMO[137]:
  - the Great Barrier Reef, Australia (designated a PSSA in 1990)
  - the Sabana-Camagüey Archipelago in Cuba (1997)
  - Malpelo Island, Colombia (2002)
  - the sea around the Florida Keys, United States (2002)
  - the Wadden Sea, Denmark, Germany, Netherlands (2002)
  - Paracas National Reserve, Peru (2003)
  - Western European Waters (2004)
  - Extension of the existing Great Barrier Reef PSSA to include the Torres Strait (proposed by Australia and Papua New Guinea) (2005)
  - Canary Islands, Spain (2005)
  - the Galapagos Archipelago, Ecuador (2005)
  - the Baltic Sea area, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland and Sweden (2005)
  - the Papahānaumokuākea Marine National Monument, United States(2007)

Special Area Designations Under MARPOL 73/78

– Baltic Sea – Annexes I, II, V, VI (sulphur oxide emissions control area)

– Black Sea – Annexes I, II, V

[137] http://www.imo.org/environment/mainframe.asp?topic_id=1357

- Mediterranean Sea – Annexes 1, V

- Gulfs Area (Arabian/Persian) – Annexes I, V

- Red Sea – Annexes I, V

- Gulf of Aden – Annex I

- Antarctic Treaty Area – Annexes I, II, V

- North Sea – Annex V

- Wider Caribbean – Annex V

- North West European Waters – Annex I (North Sea and approaches, Irish Sea and approaches, English Channel and approaches, and NE Atlantic immediately west of Ireland).

Threats to Marine Protected Areas and Species
Global Agreements
From Marine Pollution

- From Ships – See Table 2:1

- From Dumping – See Table 2:2

- From Land-based Activities – See Table 2:4

- From Offshore Activities – See Table 2:5

- From Airborne Sources – See Table 2:6

From Mariculture – See Table 2:7

From Unsustainable Fisheries – See Table 2:7

From Non-Indigenous Species Introductions (See also Table 2:1., and Table 3:3 on Technical Guidance on Fisheries, Mariculture and Marine Species)

- UN Convention on the Law of the Sea. <u>In force 1994</u>

- Convention on Biological Diversity. <u>In force 1993.</u>
- Code of Practice on the Introductions and Transfers of Marine Organisms (1994). <u>Non-binding.</u> This supersedes earlier versions of 1973, 1979, and 1990.

- Code of Conduct for Responsible Fisheries (FAO,1995). <u>Non-binding.</u>

From Genetically Modified Organisms (GMOs)

- Convention on Biological Diversity. <u>In force 1993.</u>

- Cartagena Protocol on Biosafety (2000). <u>In force September 2003.</u>

- Regional Agreements on GMOs (all <u>non-binding</u>):
  - European Union Directive: on the deliberate release into the environment of genetically modified organisms (1990).
  - Convention on Civil Liability for damages resulting from activities dangerous to the environment (1993). <u>Not in force</u>

Scientific and Technical Institutional Support – Marine Species

This list identifies specialised technical institutions that are regional or global and is by no means exhaustive.

Global Organisations

Marine Species/Habitats

- World Conservation Monitoring Center (WCMC)
- Wetlands International
- World Conservation Union (IUCN)
- United Nations Environment Programme (UNEP)

Fisheries/Aquaculture

- FAO
- Group of Experts on the Scientific Aspects of Marine Environment Protection (GESAMP)
- International Centre for Living Aquatic Resources Management (ICLARM)

Regional Organisations

FAO Regional Fisheries Organisations[138]

- Asia-Pacific Fishery Commission (APFIC). Established 1948 (formerly the Indo-Pacific Fishery Commission)
- Fishery Committee for the Eastern Central Atlantic (CECAF). Established 1967
- General Fisheries Commission for the Mediterranean (GFCM). Established 1949. This includes the Black Sea.
- Indian Ocean Tuna Commission (IOTC). Established 1993.
- Western Central Atlantic Fishery Commission (WECAFC). Established 1973

Non-FAO Regional Organisations (Regional Fisheries Conventions are listed at Table 2:7)

- International Council for the Exploration of the Sea (ICES). Established 1902, North Atlantic.
- International Commission for the Scientific Exploration of the Mediterranean (ICSEM). Established 1910.
- North Pacific Marine Science Organisation (PICES). Established 1990.
- Southeast Asian Fisheries Development Centre (SEAFDEC).[139] Established 1967
- Secretariat of the Pacific Community (SPC).[140] Established 1947, formerly South Pacific Commission.
- Organization for the Asia-Pacific Network of Aquaculture Centres (1988 Agreement, see Table 2:7).
- Permanent Commission for the South Pacific (CPPS). Established 1952.
- Latin American Organization for Fishery Development (OLDEPESCA). Established 1982. OLDEPESCA initiated the Central American Fisheries Research Centre for the Caribbean in 1988.
- South Atlantic Fisheries Commission (SAFC). Established 1991, UK and Argentina.
- Organization of Eastern Caribbean States (OECS). Established 1981.
- Caribbean Community (CARICOM). Established 1973.
- Regional Fisheries Committee for the Gulf of Guinea (COREP). 1984 Convention. Not in force.
- Sub-regional Commission on Fisheries (CSRP) – West Africa. 1985 Convention. Not in force.
- Gulf Cooperation Council.[141] Established 1981.

[138] These bodies are established either under Article VI (CECAF, WECAFC) or XIV (APFIC, GFCM, IOTC) of the FAO Constitution. Those under Article XIV may have the power to adopt potentially binding measures, but only the IOTC has assumed this power.
[139] Data on subsistence and reel fisheries.
[140] Programmes on coastal and reel fisheries, oceanic fisheries, and aquaculture.
[141] Fisheries research with some duplication of the IOFC Gulfs Committee.

APPENDIX 2.

Draft Action Plan for the Rainbow hydrothermal vent field MPA (Source: IUCN 2003a)
Goal: To get the Rainbow hydrothermal vent field established as a pilot high seas MPA in the North Atlantic.
Objective: Undertake a process which will achieve protection. The pilot shall serve to develop necessary tools, including cooperation and responsibilities to achieve protection for a wider selection of sites.

Action Steps	**Sub steps**	**Target audience**	**Actors**	**Schedule**	**Resource Needs**	**Funding possibilities**
Selection of site by problem	Problem identification	Scientists	Scientists (NGOs, governments			
	Collection of data	NGO	Scientists (NGOs, governments)	1 week	1 person	Project hours
	Selection of criteria	NGO & scientists		ongoing	1 person & buy-in from science	
	Documentation	NGO & scientists	Governments, NGOs	2 weeks		
Advocacy, lobby	Use existing contact to governments, use international network	NGO all levels, supporting scientists	Governments	Opportunities, eg OSPAR Meetings		
Identification of legal tools and advice		Legal expert, commissioned by NGO	Governments	1 month	1 consultancy	In-house funding or outside support
Action Steps	**Sub steps**	**Target**	**Actors**	**Schedule**	**Resource**	**Funding**

		audience			Needs	possibilities
		audience			**Needs**	**possibilities**
Development & implementation of strategy – make it a project		NGO & supporting groups, institutions – network building	To get everyone engaged	1 year	1 project officer full time	Sponsorship, matching contributions, EC funding
Awareness building						
Partnerships						
"Marketing the initiative"						
Advocacy …						